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NEXT YEAR'S EXHIBITION.

By INVENTOR.

THE operations of exhibitions are very manifold. Primarily, I suppose, they are intended for educational purposes, to show people what advances have been made in the development and product of the human intellect. Were this, however, the only purpose they are capable of serving, we should find these now oft-recurring shows attain but very shadowy dimensions compared with what is actually seen. In reality, an exhibition has a more or less distinct business ring about it, and if this element is once lost sight of, the fate of the show is almost infallibly sealed. Much was said and done to give backbone to the greatest educational effort ever put forth in this direction, viz., the Loan Exhibition of 1876. It was a grand display—such a one, perhaps, as will never again be seen; it was purely educational; the business element was conspicuously absent, and consequently, although not so decided a failure as some, it cannot be said that the exhibition was a success, particularly when compared with that which has been achieved by more recent shows.

A similar fate attended the Exhibition of Electrical Apparatus at the Albert Hall. The Paris Exhibition of 1880-1, and the Crystal Palace Exhibition of 1881-2, regarded electricity as a marketable something, and succeeded—that is to say, they paid their expenses and left a balance, stimulated trade and spurred on scientists as well as unscientific inventors to produce something even better than the best then producible. And these I take to be some of the main points to be regarded in estimating the measure of success accomplished.

It follows by implication that for an exhibition to succeed, not only must the guarantors be relieved of all anxiety so far as the claims upon their pockets are concerned, but the exhibitors must see a prospect of recouping themselves. To collect and adorn a case or stand of commodities more or less novel, to print circulars, to pay the cost of packing, of carriage and fixing, &c., involves no small expense, which, if there is little or no prospect of business, the would-be exhibitor is not likely to incur. And why should he? Are we to suppose him to be endowed with a greater share of self-abnegating philanthropy than the rest of mankind? It is all very well for a wealthy or independent man to exhibit his hobby, or for a traveller to display his collection of curiosities; but, if we waited for a sufficient number of such enthusiasts, we should be compelled to wait for many a year, and then, doubtless, we should only succeed in getting together such a motley collection as would please nobody, not excepting even the exhibitors themselves. The man of the world, the man of business, knows full well that a show which is purely educational will have little attraction for the great majority of people, and it is only by the drawing together of great crowds, and entertaining and interesting as well as instructing them, that he can hope to defray his expenses and pay himself for his trouble. Would it were otherwise; but we must take people as we find them, and this I take to be the main feature which, though perhaps never formulated, affords excuse for the general plan adopted by the executive councils of the present Kensington exhibitions.

There are, of course, some points we might feel disposed to find fault with; they are so far too superficial, and possibly offer too many facilities for airing the obtrusive peculiarities of certain people; but we should be unjust were we to blame the working class for not being wiser or more cultured than they are. Maybe the fault rests more with the teachers. Indeed, it is to remove as much of the existing ignorance as possible that KNOWLEDGE is issued week by week, and we are fond of regarding the pages of this journal as among the educational influences of the day

The mere show of articles of every-day consumption is, however, little calculated to educate, or even to interest, the beholders, and can only find excuse from an advertising standpoint. Such displays are, in fact, outside the business region of my purview.

The coming Exhibition of Inventions and Musical Instruments promises to be of such a nature as to satisfy the hungriest searcher after knowledge, while, at the same time, business people will see in it an opportunity for entering into competition with the keenest energy. Those also who will visit it for fashion's sake stand a chance of reaping some benefit from it. The field embraced by "inventions" is so extensive that we may fairly and confidently look for an excellent display, in which jam-pots and such like impedimenta will scarcely find a place. The scientific element will be more predominant, and there is, in fact, a prospect of its satisfying all sections of the community. Music is doubtless introduced as a kind of leaven. The idea upon which the exhibition is planned is not to bring together a mere collection of models of inventions, but rather to illustrate the progress which has been made in the practical application of science during the past twenty years. In order to carry out this intention, the council will, as far as possible, confine the exhibits to processes and appliances, products being admitted only where they are themselves novel, or where their introduction is required to make the purpose or advantages of that which is new in any process more interesting and intelligible. It is not proposed to allot space for manufactured goods unaccompanied by any illustrations of the process of manufacture. Generally, it may be said that, as far as is practicable, inventions will be shown by models, with, in the case of models of entire machines, actual specimens of the portions improved under the exhibitor's patent, and when the invention relates to parts only, the whole machine will not be admitted, unless, indeed, the improvement effected

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cannot be sufficiently shown without the exhibition of the entire apparatus. The limitations of space which make these restrictions necessary, also compel the Council to decline, unless in exceptional circumstances, to receive objects which have already been shown in either of the recent exhibitions.

The second division—music—will, of course, be arranged on somewhat different principles. Here the object will be to illustrate as completely and in as interesting a manner as may be all that relates to the development of the science and of the art of music. Examples of musical instruments of a date not earlier than the commencement of the present century, and any machinery, apparatus, or appliances connected with their manufacture or their use, will be admissible. And, further, without restriction of date, contributions to an historic collection of musical instruments, and paintings and engravings representing musical subjects, are invited, and many, it is known, will be forthcoming.

Criticism at this early stage is practically out of the question, but the Council includes such a phalanx of good men (Sir Frederick Bramwell, F.R.S., vice-president of the Institute of Civil Engineers, Sir Frederick Abel, C.B., Mr. I. Lowthian Bell, F.R.S., president of the Institute of Mechanical Engineers, Colonel Sir Francis Bolton, Professor Dewar, F.R.S., Sir George Grove, D.C.L., Mr. W. H. Preece, F.R.S., Sir E. J. Reed, M.P., F.R.S., Professor Chandler Roberts, F.R.S., Dr. Stainer, Mr. R. E. Webster, Q.C., &c.), that there will, I fancy, be little to find fault with.

One thing is very certain, and that is, that the Exhibition will be one from which excellent results may, and most assuredly will, be looked for. The first division will be divided into some thirty or thirty-one groups, and single specimens of the objects mentioned in the prospectus would in themselves constitute a show of no mean proportions. We hope, naturally, for something more than this. Practically, every branch of human industry is taken up—and, indeed, it is almost a matter of impossibility to conceive how any one thing could be regarded as outside the scope embraced by the title. It follows that there will be whole multitudes who will visit the Exhibition, and who will leave it minus that benefit which they ought to derive. It will be the duty of KNOWLEDGE to help its readers to grasp more truly the lessons to be learned from what we have no doubt will be a great and a highly interesting exhibition. Such exhibits as may be likely to prove beneficial to the community will be referred to, and described more or less fully, sight not being lost of the fact that while many of our readers may be able to view the objects themselves, many others, possibly the majority, will be debarred for various reasons from ever visiting the Exhibition.

THE ENTOMOLOGY OF A POND.

By E. A. Butler.

THE BOTTOM (*continued*).

THE *Ranatra linearis* is a creature of three elements, though, of course, its proper sphere is the water. It can manage to progress on land better than most aquatic insects, carrying its body high up on its stilt-like second and third pairs of legs; still, its movements are, at best, but slow and awkward. It will also, sometimes, take to the air, and on returning to its pond, finds occasionally a little difficulty in re-entering the water, on account of its own slight specific gravity and the dryness of its tail filaments, so that quite a struggle is necessary before it is completely immersed. It is a sluggish insect, and will often remain motionless amongst the pond weeds for a long time together, only rising to the surface to breathe, and this, as one might expect in so inactive an insect, it needs to do very infrequently. It makes its way through the water, either by the help of aquatic plants, or by the movements of its two hind pairs of legs; but these are worked somewhat peculiarly, the third pair being driven backwards at the same time that the second are moved forwards, and *vice versâ*, all the movements being performed in a leisurely manner. But when we come to the front legs, the case is altogether different; all the celerity of which the insect is capable seems to be concentrated here. Ranatra, indeed, is more of a living trap than a hunter, lying in wait for, more frequently than pursuing, its prey, which consists of other aquatic insects, especially the larvæ of Mayflies, and even small fishes. With fore-legs extended, it patiently waits till some unwary and unsuspicious being, on pleasure only bent, approaches within the charmed circle guarded by those long-handled sickles, and then, with a rapid and forcible stroke and with unerring aim, down come the powerful limbs and seize the hapless pleasure-seeker as between a pair of pincers. Dragged to the cruel beak of its thirsty foe, its juices are gradually extracted, and the grasp is not relaxed till the dregs have been drained and nothing but the skin is left; the useless pellicle is then rejected and the lanky tyrant brings itself into position for another attack. It is said sometimes to regale itself on fish spawn, a proceeding which naturally excites the ire of pisciculturists. It holds its prey with astonishing tenacity, of which the following instance, recorded in the "Entomologist," by Mr. A. G. Laker, may serve as an example. He says:—"I placed some sticklebacks in the glass with a Ranatra, when one of them, about an inch long, was seized (the total length of the Ranatra, exclusive of its anal filaments, being only eighteen lines), and, notwithstanding the fish's repeated and vigorous struggles, it was held fast. I then took hold of the stickleback and raised it out of the water; the Ranatra, however, would not let go, and was drawn out of the water with the fish. I forcibly separated the two, replaced the insect, and immediately afterwards the fish; but the latter was again seized in a very short time, and the insect continued its meal." Ranatra is an exceedingly bold and fearless insect, manifesting surprising readiness to attack any foe, let its size be what it may. In fact, under ordinary circumstances, there are probably but few enemies that it has any need to fear. It is the giant of the insect population of the pond, and can hold its own against almost all comers. The great Dytisci are probably the only insects of which it has any need to stand in awe; and these, if hard pressed by hunger, would probably have no hesitation in attacking it, and, protected by the invulnerable nature of their chitinous armature, would soon make mincemeat of the slim and long-legged bug. The hard integument of beetles, however, does not always baffle Ranatra, not even when it seems to offer an insurmountable obstacle. There is a little oval, reddish-brown beetle, *Hyphydrus ovatus* by name, about the size of a small pea, and not unlike a somewhat flattened one in shape, which is about as unmanageable a morsel as could well fall to the lot of any insect; but even this Ranatra will not refuse, turning and twisting it about with its pincers in vain efforts to find a soft spot in which to plunge its beak, till at last it lights upon the extremity of the abdomen, as being a little less hard than the rest, and manages to extract even thence at least enough nutriment to whet its appetite and make it long for more.

Our other British water-scorpion, *Nepa cinerea* (Fig. 1), occurs commonly in ponds. It is a smaller and much broader insect, extremely flattened (like many other bugs, notably our disgusting household pest), with shorter and stouter legs, but still similar in plan to Ranatra, which it resembles also in its brilliant scarlet body. It is a most sluggish insect, and can easily be secured by the hand when seen near the edge of the pond; but the difficulty is to catch sight of it, for so exactly similar is its colour to that of the mud amongst which it lies, that unless the observer can bring to bear upon it a pair of keen and well-trained eyes, it will in nine cases out of ten remain undetected, if only it have the sense not to betray its presence by moving. In consequence of its sluggish habits and mud-loving propensities, it sometimes becomes covered with an incrustation which does not render its detection any the easier. Its protective coloration, no doubt, gives it chances of many more meals than it would otherwise get, for unwary insects will often approach near enough to come within range of the hooked fore-feet without being conscious of the risk they run, and are only aroused from their fancied security by finding themselves suddenly clutched and pressed in a deadly embrace against the sharp beak which is ever in waiting to tap any juicy body that may be presented to it.

Fig. 1.

The breathing apparatus is a marvel of complexity; there are both spiracles and tail filaments, the latter leading into the two longitudinal tracheæ, which run parallel to the sides. From these, innumerable minute tubes ramify all over the body, and if only it were possible to dissect out the whole tracheal system, and separate it from the rest of the body, it would form a most elegant object, and appear like an exquisite network of silver filagree, built up, as it were, upon a gridiron-like framework consisting of two long curved side-pieces connected by arched cross-pieces. In the thorax there are a few dilatations of the tracheal system, in the form of air-bags, such as in many other insects, especially those that are vigorous in flight, may be found in other parts of the body as well.

The eggs of Nepa are very peculiar. They are oval, with seven long filaments at one end; while they are being laid, the filaments of each serve as a sort of cup to keep its successor in position, but when the egg is once deposited, the filaments bend backwards and form a circlet of recurved hooks. The eggs of Ranatra are more elongate, and furnished with only two bristles.

As these water-scorpions are bugs, they do not undergo much change of form in the course of their life; the larvæ are very similar to the adult, the chief differences being the smaller size and the absence of wings and tail-filaments, the place of the latter being taken by a small pointed projection.

(To be continued.)

THE PHYSICS OF THE EARTH'S CRUST.

By Richard A. Proctor.

PROFESSOR DAVIDSON, of the United States Geodetical Survey in California, has noticed most remarkable deviations in the direction of the action of gravity in the region which he has surveyed. Deflections of ten or eleven seconds of arc—which would correspond, in the determination of the position of a place by astronomical methods, to errors of 1,000 or 1,100 feet—are common. This shows that the density of the materials beneath the visible surface of the earth is very irregular. But what is remarkable is that the deviations of the plumb-line (so, for convenience, to describe a peculiarity which in reality is far too delicate to be dealt with by a plumb-line observation) are not, as might be expected, towards the great mountain ranges, but towards the regions of depression. It would seem that the depressions indicate the downward tendency of very dense matter, and a resulting closeness of packing, so to speak, which makes those depressed regions exert a very powerful local attraction, causing the plumb-line in their neighbourhood to deviate towards them. On the contrary, in the neighbourhood of the mountain ranges, and even on their flanks, the deflection of the plumb-line is *from* the regions of elevation, as though vacant spaces or matter of relatively small density existed beneath the upheaved portions of the crust.

Another point, still more remarkable, and apparently established on sufficient evidence, is that in certain regions the direction of gravity seems to have changed largely during a period of less than thirty years. Professor Davidson mentions one place where the position, as determined by astronomical methods depending on the direction of gravity, has varied no less than 16 seconds of arc since 1854. The arrangement of the masses beneath the surface in the neighbourhood must have greatly changed—marvellously, in fact, when the shortness of the time is considered. One cannot wonder that California should be a region of great earthquakes, insomuch that no large building can safely be made of stone in that part of the earth.

Prof. Davidson's observations tend to throw some doubt on all such methods of determining the earth's density as depend on variations in the force and direction of gravity in the neighbourhood of mountain masses, at the bottom of deep mines, and so forth. It is certain that had such observations been first made in such a region as California, they would have led to entirely erroneous results, or, rather, they would have failed utterly; for it appears that instead of the plumb-line being deflected towards the upraised masses (supposed to be of known density), as in the case of the Schehallion experiment, it would have been drawn from them towards masses of compressed matter beneath the lower levels, and before unsuspected. As for pendulum experiments in mines, such as the celebrated Harton Colliery observations, they seem utterly discredited by such observations as Professor Davidson's. But, to say the truth, they have long been regarded as worthy of little trust. In dealing with Airy's observations (really conducted by his assistant, Mr. Dunkin), in Rodwell's "Physical Cyclopædia," I pointed out fifteen years ago that the result obtained was altogether unreliable, chiefly because of the uncertainty necessarily existing in regard to the density of the regions surrounding the scene of operations. The result obtained at Schehallion by Maskelyne was more nearly correct, judged by the indications of the Cavendish experiment, the only method which seems really trustworthy. But what was learnt from the Schehallion experiments was simply that the rock masses in that region are tolerably uniform in structure, and of about the mean density assigned by Maskelyne, *not* that the earth has the mean density deduced by that observer from his observations there. This last we learn from Baily's experiments by the Cavendish method, in which the earth is weighed against metallic masses of known density.

Other observations in California show how little reliance

can be placed on certain results which have been accepted with considerable confidence. Not only does the rate of increase of temperature with descent vary greatly in different regions, but in some places the law is reversed. Thus, in the new Almaden Quicksilver Mine in California, the temperature is about 115° at a depth of 600 ft., while in the deepest part of the mine, 1,800 ft. below the surface, and 500 ft. below the sea level, the temperature is not higher than 80°. At the Eureka mines, California, the temperature, 1,200 ft. below the sea level, is not higher than it is 100 ft. below that level.—*The Newcastle Weekly Chronicle.*

THE CHEMISTRY OF COOKERY.

By W. Mattieu Williams.

XLI.—AUTHORITIES ON TEA AND COFFEE.

SINCE the publication of my last I have been reminded of the high authorities who have defended the use of the alkaloids, and more particularly of Liebig's theory, or the theory commonly attributed to Liebig, but which is Lehmann's, published in Liebig's "Annalen," Vol. 87, and adopted and advocated by Liebig with his usual ability.

Lehmann watched *for some weeks* the effects of coffee upon two persons in good health. He found that it retarded the waste of the tissues of the body, that the proportion of phosphoric acid and of urea excreted by the kidneys was diminished by the action of the coffee, the diet being in all other respects the same. Pure caffeine (which is the same as theine) produced a similar effect, the aromatic oil of the coffee, given separately, was found to exert a stimulating effect on the nervous system.

Johnstone ("Chemistry of Common Life") closely following Liebig, and referring to the researches of Lehmann, says:—"The waste of the body is lessened by the introduction of theine into the stomach—that is, by the use of tea. And if the waste be lessened, the necessity for food to repair it will be lessened in an equal proportion. In other words, by the consumption of a certain quantity of tea, the health and strength of the body will be maintained in an equal degree upon a smaller quantity of ordinary food. Tea, therefore, saves food—stands to a certain extent in the place of food—while, at the same time, it soothes the body and enlivens the mind."

He proceeds to say that "In the old and infirm it serves also another purpose. In the life of most persons a period arrives when the stomach no longer digests enough of the ordinary elements of food to make up for the natural daily waste of the bodily substance. The size and weight of the body, therefore, begin to diminish more or less perceptibly. At this period tea comes in as a medicine to arrest the waste, to keep the body from falling away so fast, and thus to enable the less energetic powers of digestion still to supply as much as is needed to repair the wear and tear of the solid tissues." No wonder, therefore, says he, "that the aged female, who has barely enough income to buy what are called the common necessaries of life, should yet spend a portion of her small gains in purchasing her ounce of tea. She can live quite as well on less common food when she takes her tea along with it; while she feels lighter at the same time, more cheerful, and fitter for her work, because of the indulgence."

All this is based upon the researches of Lehmann and others, who measured the work of the vital furnace by the quantity of ashes produced—the urea and phosphoric acid excreted. But there is also another method of measuring the same, that of collecting the expired breath and determining the quantity of carbonic acid given off by combustion. This method is imperfect, inasmuch as it only measures a portion of the carbonic acid which is given off. The skin is also a respiratory organ, co-operating with the lungs in evolving carbonic acid.

Dr. Edward Smith adopted this method of measuring the respired carbonic acid. His results were first published in "The Philosophical Transactions" of 1859, and again in Chapter XXXV. of his volume on "Food," International Scientific Series.

After stating, in the latter, the details of the experiments, which include depth of respiration as well as amount of carbonic acid respired, he says:—"Hence it was proved beyond all doubt that tea is a most powerful respiratory excitant. As it causes an evolution of carbon greatly beyond that which it supplies, it follows that it must powerfully promote those vital changes in food which ultimately produce the carbonic acid to be evolved. Instead, therefore, of supplying nutritive matter, it causes the assimilation and transformation of other foods."

Now, note the following practical conclusions, which I quote in Dr. Smith's own words, but take the liberty of rendering in italics those passages that I wish the reader to specially compare with the preceding quotations from Johnstone:—"In reference to nutrition, we may say that *tea increases waste*, since it promotes the transformation of food without supplying nutriment, and increases the loss of heat without supplying fuel, and *it is therefore especially adapted to the wants of those who usually eat too much*, and after a full meal, when the process of assimilation should be quickened, but *is less adapted to the poor and ill-fed*, and during fasting." He tells us very positively that "to take tea before a meal is as absurd as not to take it after a meal, unless the system be at all times replete with nutritive material." And, again, "Our experiments have sufficed to show how tea may be *injurious if taken with deficient food, and thereby exaggerate the evils of the poor;*" and, again, "The conclusions at which we arrived after our researches in 1858 were that tea should not be taken without food, unless after a full meal; or with insufficient food; or by the young or very feeble; and that *its essential action is to waste the system or consume food*, by promoting vital action which it does not support, and they have not been disproved by any subsequent scientific researches."

This final assertion may be true, and to those who "go in for the last thing out," the latest novelty or fashion in science, literature, and millinery, the absence of any refutation of later date is quite enough.

But how about the previous scientific researches of Lehmann, who, on all such subjects, is about the highest authority that can be quoted. His three volumes on "Physiological Chemistry," translated and republished by The Cavendish Society, stand pre-eminent as the best-written, most condensed, and complete work on the subject, and his original researches constitute a lifetime's work, not of mere random change-ringing among the elements of obscure and insignificant organic compounds, but of judiciously selected chemical work, having definite philosophical aims and objects.

It is evident from the passages I have emphatically quoted that Dr. Smith flatly contradicts Lehmann, and arrives at directly contradictory physiological results and practical inferences.

Are we, therefore, to conclude that he has blundered in his analysis, or that Lehmann has done so?

On carefully comparing the two sets of investigations, I conclude that there is no necessary contradiction *in the facts;* that both may be, and in all probability are, quite correct as regards their chemical results; but that Dr.

Smith has only attacked half the problem, while Lehmann has grasped the whole.

All the popular stimulants, refreshing drugs, and "pick-me-ups" have two distinct and opposite actions—an immediate exaltation which lasts for a certain period, varying with the drug and the constitution of its victim, and a subsequent depression proportionate to the primary exaltation, but, as I believe, always exceeding it either in duration or intensity, or both, thus giving as a nett or mean result a loss of vitality.

Dr. Smith's experiments only measured a partial result (the carbonic acid exhaled from the lungs without that from the skin) *of the first stage*, the period of exaltation. His experiments were extended to 50 minutes, 71 minutes, 65 minutes, and in one case to 1 hour and 50 minutes. It is worthy of note that in Experiment 1 were 100 grains of black tea, which were given to two persons, and the time of the experiment was 50 and 71 minutes; the average increase was 71 and 68 cubic inches per minute, while in No. 6, with the same dose and the carbonic acid collected during 1 hour and 50 minutes, the average increase per minute was only 47·5 cubic inches. These indicate the decline of the exaltation, and the curves on his diagrams show the same. His coffee results were similar.

We all know that the "refreshing" action often extends over a considerable period. My own experiments on myself show that this is three or four hours, while that of beer or wine is less than one hour (moderate doses in each case).

I have tested this by walking measured distances after taking the stimulant and comparing with my walking powers when taking no other beverage than cold water. The duration of the tea stimulation has been also measured (painfully so) by the duration of sleeplessness when female seduction has led me to drink tea late in the evening. The duration of coffee about one-third less than tea.

Lehmann's experiments extending over weeks (days instead of minutes), measured the whole effect of the alkaloid and oil of the coffee during both the periods of exaltation and depression, and, therefore, supplied a mean or total result which accords with ordinary everyday experience. It is well known that the pot of tea of the poor needlewoman subdues the natural craving for food; the habitual smoker claims the same merit for his pipe, and the chewer for his quid. Wonderful stories are told of the long abstinence of the drinkers of maté, chewers of betel-nut, Siberian fungus, coca-leaf, and pepper-wort, and the smokers and eaters of haschish, &c. Not only is the sense of hunger allayed, but less food is demanded for sustaining life.

It is a curious fact that similar effects should be produced, and similar advantages claimed for the use of a drug which is totally different in its other chemical properties and relations. "White arsenic," or arsenious acid, is the oxide of a metal, and far as the poles asunder from the alkaloids, alcohols, and aromatic resins, in chemical classification. But it does check the waste of the tissues, and is eaten by the Styrians and others with physiological effects curiously resembling those of its chemical antipodeans above named. Foremost among these physiological effects is that of "making the food appear to go farther."

It is strange that any physiologist should claim this diminution of the normal waste and renewal of tissue as a merit, seeing that life itself is the product of such change, and death the result of its cessation. But in the eagerness that has been displayed to justify existing indulgences, this claim has been extensively made by men who ought to know better than admit such a plea.

I speak, of course, of the *habitual* use of such drugs, not of their occasional medicinal use. The waste of the body may be going on with killing rapidity, as in fever, and then such medicines may save life, provided always that the body has not become "tolerant," or partially insensible, to them by daily usage. I once watched a dangerous case of typhoid fever. Acting under the instructions of skilful medical attendants, and aided by a clinical thermometer and a seconds watch, I so applied small doses of brandy at short intervals as to keep down both pulse and temperature within the limits of fatal combustion. The patient had scarcely tasted alcohol before this, and therefore it exerted its maximum efficacy. I was surprised at the certain response of both pulse and temperature to this most valuable medicine and most pernicious beverage.

The argument that has been the most industriously urged in favour of all the vice-drugs, and each in its turn, is that miserable apology that has been made for every folly, every vice, every political abuse, every social crime (such as slavery, polygamy, &c.), when the time has arrived for reformation. I cannot condescend to seriously argue against it, but merely state the fact that the widely-diffused practice of using some kind of stimulating drug has been claimed as a sufficient proof of the necessity or advantage of such practice. I leave my readers to bestow on such a plea the treatment they may think it deserves. Those who believe that a rational being should have rational grounds for his conduct will treat this customary refuge of blind conservatism as I do.

THE ELECTRO-MAGNET.

By W. Slingo.

THE experiments referred to at the close of the previous article as having been made by Professors Ayrton and Perry* present many features full of interest and worthy of study. They are all such as may be easily repeated by the student. The object was to determine which mode of winding a given length of wire on an iron bar gave the strongest electro-magnet for the same current. Four bars of iron, each 12 inches long, were cut from the same rod $\frac{3}{8}$ in. thick; and an exactly equal length of wire was wound on the four bars respectively, in the following way :—

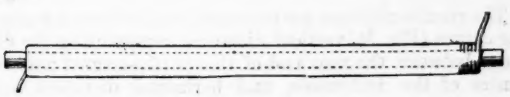


Fig. 1

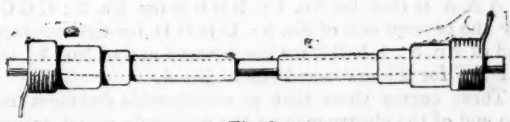


Fig. 2.

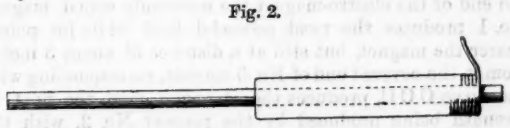


Fig. 3.

1. Wire wound equally over the whole length, Fig. 1.
2. Wire coned towards each end, Fig. 2.
3. Wire wound equally over half the iron bar, leaving the other end bare (Fig. 3).

* "Phil. Mag.," Vol. XV., p. 397.

4. Wire wound on one half, but coned towards the end (Fig. 4).

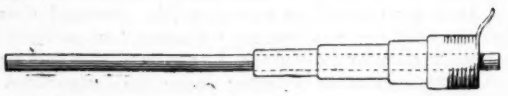


Fig. 4.

To ascertain their relative strengths, electro-magnet No. 1 was put so that its axis was at right angles to the axis of a small magnetic needle and passed through the point of suspension of the needle, which was suspended so as to move freely in a horizontal plane, and far enough away that the magnetic field due to the electro-magnet, when magnetised by passing a current through it, was nearly constant over that portion of the field in which the little suspended needle moved when deflected. A constant current was now passed through the coil, and the deflection of the little needle observed when the electro-magnet was placed at different distances from the centre of the test-needle, the axis, however, always remaining in the same line. Under these circumstances, the strength of the field produced by No. 1 at the centre of the test-needle is approximately proportional to the tangent of the angle through which the needle is deflected. Experiments were made in a similar way with electro-magnet No. 2, and with each end of No. 3 and of No. 4, the same current being used in all cases.

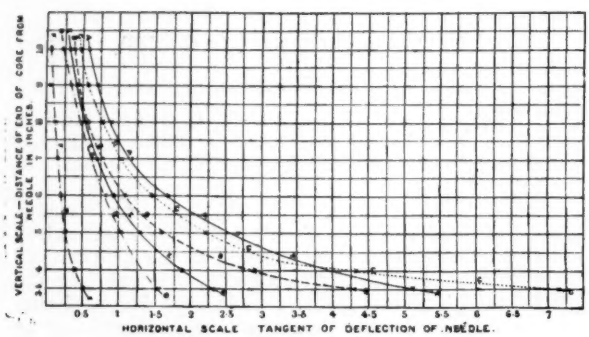


Fig. 5

The results obtained are shown plotted in the accompanying curves (Fig. 5), vertical distances representing the distance between the near end of the electro-magnet and the centre of the test-needle, and horizontal distances indicating the tangents of the deflections of the test-needle: A A A A is that for No. 1; B B B B for No. 2; C C C C for the covered end of No. 3; D D D D for the uncovered end of No. 3; E E E E for the covered end of No. 4; and F F F F for the uncovered end of No. 4.

These curves show that at considerable distances from the end of the electro-magnet the uniformly coiled magnet No. 1 produces the most powerful field, while for points nearer the magnet, but still at a distance of about 3 inches from it, the covered end of No. 3 magnet, corresponding with the curve C C C, produces the strongest field, the next in strength being produced by the magnet No. 2, with the wire coned towards each end, since obviously the curve B B B cuts the curve A A A at a point corresponding with a distance of about 3 inches from the end of the magnet. The strength of the field at shorter distances than those indicated cannot be measured by the means above adopted. There is, however, another, although perhaps a rougher, means of observing the strength of the various parts of the field produced by the electro-magnet. It is well known that a magnet is capable of attracting iron filings, and that they take up definite positions when attracted. It is also an every-day experiment to lay a magnet under a sheet of paper, thin glass, or other non-magnetic material, upon which iron filings are then sprinkled, when they form certain definite figures. If the magnet is a straight bar of steel, the filings take up their position in a manner analogous to that depicted in Fig. 6. Professors Ayrton and Perry pursued a similar course in investigating the magnetic properties of their coils, and obtained some interesting and instructive results.

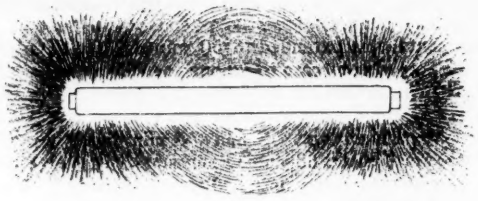


Fig. 6.

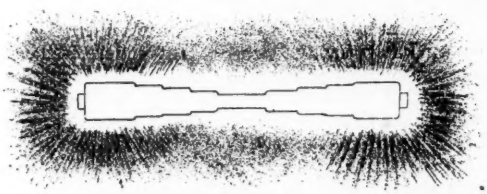


Fig. 7.

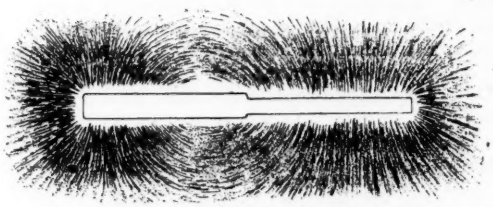


Fig. 8.

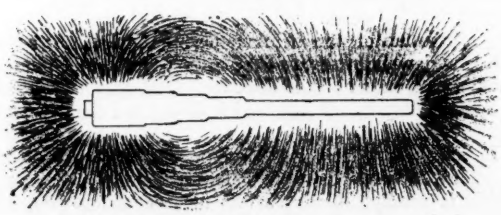


Fig. 9.

Figs. 6, 7, 8, 9 afford remarkable illustrations of the effects produced. The iron filings are seen to take up definite positions, and supposing Fig. 6 to represent an ordinary bar magnet, there is observable a concentration of filings around the extremities indicating the positions of maximum magnetic strength. It will also be noticed that all the filings set themselves in curves, and that these curves exhibit a strong tendency to connect the one pole with the other, much in the same way that they do when the poles of an ordinary horse-shoe magnet are dipped into a quantity of filings. Even the apparently straight lines taken by the filings at the extremities (Fig. 6) are in reality only parts of large curves, easily discernible in the actual experiment.

The effect, then, of winding an electro-magnet evenly is to produce an ordinary magnetic field as shown in Fig. 6. With the second mode of winding, *i.e.*, coning the wire towards the two ends of the iron, we obtain a field (Fig. 7) similar to the one produced by the usual winding, with the exception that the field between the poles is very weak. With the two other modes of winding (Nos. 3 and 4) there is a considerable concentration of force in the vicinity of the covered end, while the uncovered end "seems to form a long, weak pole," the difference between the two being that with No. 4 as contrasted with No. 3 there is a greater concentration at the wound end, and that the opposite pole is longer. The movement made by the "neutral zone" towards the left hand is clearly indicated.

The professors completed their experiments by ascertaining the weight necessary to detach the armature from the covered end of each magnet, a constant or equal current flowing through each coil. The result was that with :—

1	45	ounces were required to detach the armature.		
2	57	"	"	"
3	57	"	"	"
4	77	"	"	"

These results show, then, that the effect of coning the wire is to produce a strong field near the pole, which, however (as may be gathered from Fig. 5), falls off rapidly as the distance from the pole increases. It is also seen that in contact or close proximity with the magnet numbers, 2 and 3 are equal, and are stronger than No. 1, while the effect produced by No. 4 is much greater than that produced by either of the others. The deductions to be drawn are that with a given piece of iron, a given length of wire, and a given current, at distances from the end of the magnet very small compared with the length of the core, the wire should be coiled up at the near end. At points a little removed, equal, say, to one third the length of the core, winding evenly over one half is advantageous, while, for greater distance, uniform winding is the best.

THE EARTH'S SHAPE AND MOTIONS.

By Richard A. Proctor.

(*Continued from page* 152.)

CHAPTER III.—THE ANNUAL MOTION OF THE SUN AND STARS.

ALTHOUGH during a single day the sun's motion is such as I have described it, yet it is impossible to watch the sun many days without noticing that the place of his rising and setting is continually changing, and also the elevation which he attains when in the south. Supposing our observations to commence in spring, we should notice that the sun began to rise further and further to the north of east, setting, of course, further and further to the north of west. We should further see his mid-day elevation gradually increasing. In about three months these changes would attain their greatest effect, and at this time we should find that the sun rose almost as far north as north-east, and set almost as far north as north-west, while at mid-day he attained an elevation of no less than 62°, instead of 38½°, as at first. Then in the next three months we should find these changes taking place in reverse order, so that at the end of the three months the sun would be rising nearly in the east and setting nearly in the west, as at the beginning of the observations. After this the sun would be found to rise towards the south of east, setting towards the south of west, while his mid-day elevation would continue to diminish. At the end of three more months these changes would produce their greatest effect, when the sun would be rising nearly as far south as south-east, and setting nearly as far south as south-west, attaining a mid-day elevation of only 15°. Lastly, during the next three months the sun would gradually return to the path he had at the beginning of the observations.

Year after year these circumstances are repeated with the utmost regularity, so that the observer would find no difficulty in forming a table recording the height which the sun would attain when due south on any day of the year. This, at present, is all that we shall note on this point. We shall shortly have to return to this part of our subject, and by considering the annual changes of the sun's apparent path more exactly—that is, in quantity and measure, instead of in a general manner, we shall be enabled to form an estimate of the real character of the sun's annual motion relatively to our earth. At present, however, our observer is supposed to be limiting his attention to those observations which may enable him to determine the earth's figure by travelling from the scene of his first researches. He is, in fact, endeavouring to learn how the sun or the stars would seem to move on any day of the year, as seen from his first station, in order than when he goes to others he may estimate the effect of change of place on these motions, and so learn what is the shape of that surface over which he is travelling.

Our observer might notice also with special care where the sun rises and sets on different days, were it not that after some attention to this point, he would find that in the immediate neighbourhood of the horizon, celestial objects are not seen in their true places. He would quickly see that this was an atmospheric effect, because he would notice that even terrestrial objects, at a considerable distance, appear often to be disturbed or distorted. Presently this peculiarity will need to be carefully considered. At present, all that is necessary is that the observer should avoid laying any stress on the observations of celestial objects when very close to the horizon.*

The result, then, to which our observer pays special attention is the circumstance that on any given day in the year the sun always attains a certain elevation when in the south. If he should find that when he travels to some other place, the sun, on any particular day, *does not* attain the elevation it would have had as seen from his first station, he will have to explain that circumstance—he will, in fact, have something to guide him to a true estimate of the earth's figure, of which, at present, he is supposed to know nothing, except that it has limits.

In the meantime, and with a similar end in view, he notices the annual changes in the apparent position of the stars. This part of his work also leads to certain definite and very interesting results.

Night after night he sees the stars following the same orderly movements which he had before detected. But gradually he begins to notice, that, at any given hour of the night, the aspect of the heavens is not the same as at the same hour on the first night of observation. The stars seem to have got further forward in their apparent rotation-movement.

Carefully noticing this change, he is led to the conclusion that it is taking place in a regular manner. He can very effectually test its rate and character by means of the instrument figured in Chapter I. (Fig. 5), modified (as described in Chapter II.) for sidereal observation. He

* It may be necessary to remind the reader that the refractive effects of the atmosphere slightly affect the apparent position of every celestial object, but in this part of my subject I avoid all reference to corrections so minute that the simple process of observation I am describing would not suffice to detect them.

directs the tube L M at a given hour on any night to a certain star, and notices what division of the card circle, H K, falls opposite the mark on the upright. At the same hour on the next night, he will scarcely notice any appreciable change; but if he repeat the observation a fortnight later, he will find that he has to turn the card circle round about as much as for an hour's diurnal motion—that is, through about 7½°—before L M points to the star. He will notice, however, that L M has not to be turned on its own pivot; in other words, he will see that the star's distance from the pole of the heavens (the point to which F G is directed) remains unchanged.

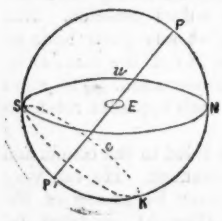
He may confirm this result by a second observation. Let him direct L M towards a star, and in any convenient manner clamp the axis F G, so that L M will remain fixed in position. Then at the end of fourteen or fifteen days let him come to the instrument an hour earlier in the evening than it was set. He will find L M pointing directly towards the star.

He finds this to be true of every visible star in the heavens, except five. Consequently, all the stars retain the same relative positions among themselves, except those five, which he will therefore look upon as wanderers, a word synonymous with the term *planet* given to these five stars by the Greek astronomers. Our observer will, for the present, however, confine his attention to the other stars, which he will call for distinction's sake the fixed stars.

He now knows that these stars have a somewhat swifter daily motion than the sun, insomuch that in half a month the stars have gained an hour's motion on the sun. It follows that in a year they have gained twenty-four hours' motion, or one complete rotation.

Now here we shall avoid any reference to the difficult processes by which the exact length of a year is determined. We will suppose that our observer is satisfied by noticing the perfect regularity of the stellar rotation, not only from hour to hour, but from day to day; and that by some means or other he enables himself to measure time with such exactness that he could detect any apparent departure from the observed regularity of motion, should any such result seem to follow from his excursions over the earth's surface. We shall see that this knowledge, combined with his knowledge of the sun's altitude at noon of every day, or even only with his knowledge of the position of the pole of the heavens, round which the rotation seems to take place, will enable him to form the most certain and conclusive opinions as to the figure of the earth on which he lives.

On one point he has already gained new information. He has noticed that the star-groups retain their configuration altogether unchanged in whatever part of the sky they may be seen. And comparing the observations of one part of the year with those of another, he is enabled to see that the stars are strewn over the surface of all that portion of a sphere having E P as axis which can rise above the horizon circle S *e* N *w* —in fact, over every part of a complete sphere S *w* P K, except the small segments S P′ K. Now, at any moment the observer can only see half of the sphere S *w* P K. He knows that unless the stars, when below the horizon, take up relative positions very different from those they have when visible, they must at every instant cover the portion S *w* N K of space beneath the horizon, and as he sees no sign of any such change when the stars are visible, while at every season of the year he sees the known star-groups unchanged in aspect, he is clearly justified in feeling very certain that no such change takes place after the stars have gone below the horizon. Hence he is certain that the earth is not only limited in the direction of the horizon, but in every direction below the horizon (except possibly towards the segment S P′ K, about which he has as yet no certain information). He will naturally infer that a complete sphere around him is bedecked with stars, and not a sphere wanting such a segment as S P′ K; but whether this be so or not, he is quite certain about the earth being limited towards all points below S *w* N K, except points in S P′ K, *for he knows that stars are strewn towards all such points.* Knowing that the earth has limits, and perhaps even suspecting already that the earth, which lies within the celestial sphere, is more likely to be in rotation than the sphere itself, he sets out to explore his abode. He will direct his explorations first towards the north, to see what changes, if any, may be perceived in the position of the apparent pole of the heavens. Then he will return and travel southwards; and, lastly, he will make a series of explorations towards the east and towards the west; until, finally, the secrets of the earth's figure shall have been completely mastered.



OUR SUPPLY OF COAL.

At a time when approximate calculations have been made of the date at which our British coal supply will be exhausted, the discovery of a reserve of some 8,000,000 tons must possess great popular, as well as more purely scientific, importance. Hence a *précis* of a lecture delivered before the members of the Cotteswold Field Club on the 12th instant, by Mr. Handel Cossham (for which we are indebted to the *Bristol Mercury and Daily Post*), can scarcely fail to be of considerable interest at once to the geologist and to the coal consumer:—

After remarking on the complicated geology of the Bristol coal-field, and particularly of the northern part of it, he mentioned that twenty years ago he was able to correct the geological maps of the district by showing that the supposed Millstone Grit, or Farewell Rock, between Bristol and Wick, was one of the Siliceous Sandstones of the coal-measures. It had consequently been discovered that the coal-bearing strata extend south of Kingswood and St. George under the river Avon, and, as far as he knew, to the Mendip Hills. That discovery had had an important bearing on the mining industry of the district, and would help in the future to unlock the mineral resources of the neighbouring county of Somerset. He had, however, now to describe a discovery he had recently made, which, he believed, would prove of much greater importance. He reminded them that the Kingswood section of the Bristol coal-field contains probably the most ancient coal workings, not only of this country, but probably older than those of South Wales, Somerset, or Dean Forest. In 1371 Edward III. issued a mandate to the keeper of the chase of Kingswood to allow Edward, the son of Hugh Blunt, lord of the manor of Bitton, to take, sell, and carry away wood, gorse, and sea-coal found within the demesne; and by the second half of the seventeenth century he saw by a map which passed to him as lord of the manor, that in the year 1672 there were no less than seventy small coal-pits at work in the Chase of Kingswood. The workings, down to the early part of this century, were of course confined to shallow depths, chiefly drained by levels into the Avon and Froom rivers, and were mainly confined to the upper section of the seams now worked in the district. About fifty years ago the Great Vein series were discovered, and have been largely worked ever since on the

South dip, and over a considerable area. Some time ago he resolved to explore the whole of the area, about 2,500 acres, the mineral freehold of which he purchased some years ago. To do this he commened an exploring drift to the south, at a depth of sixty-eight fathoms from his Belgium pit, to cut the upper section of seams that lie over the ordinary Kingswood series and between those and the Pennant rock; and at the same time he started a drift to the north, at a depth of 500 yards from the bottom of Speedwell pit, and it was the discoveries made by the latter, or north drift, from Speedwell, that he wished to describe. For some 200 yards this drift was driven in strata nearly upright, and exhibited traces of great disturbance and enormous lateral pressure; and, in fact, the whole of the Kingswood district has in past workings exhibited proofs of enormous disturbance and displacements, chiefly, as he some time ago explained in a published paper, having been produced by lateral pressure and not by vertical movements. Some 250 yards north of Speedwell pit they cut a seam of coal about 2 ft. 4 in. thick, lying in an upright position, and for a long time he supposed this to be the first of the lower or Ashton series of veins, which was what he expected to find when he drove the underground tunnel. But, extending the drift some 50 to 100 yards farther to the north, they found the strata became horizontal, and they struck a second seam of coal in several separate beds, the thickest of which was about 20 in. After following the vein for some 50 to 100 yards, he found that it was one of the old Great Vein group that had been worked 300 to 350 yards overhead up to the outcrop of the vein near the surface. This fact was so difficult to explain that he resolved, before coming to any decided conclusion, to drive cross-measure drifts to the veins above and below, so as to prove the fact beyond doubt before accepting it himself or announcing it to others. At the proper distance below this second vein, known as the Giller's End Vein, he found a particular and remarkable bed of strata, known in the district as the "Worm Bed," in its proper position in connection with this vein. He also knew that if he were correct in his opinion he should find at a distance of some 30 yards vertical above this vein the splendid seam or bed of coal known as the Kingswood Great Vein, which he had no doubt was the equivalent of the celebrated 4 feet Aberdare Steam Coal Vein. Driving a drift across measures he discovered, on the 21st of last February, the vein known as the Kingswood Great Vein, lying in splendid position, and an average of about 5 feet thick, or from that to 5 feet 6 inches, Since that time he had been driving on these veins north, east, south, and west, and found that he was on the floor of the original coalfield, with a gentle dip to the west and rise to the east of about 3 in. to the yard, and apparently extending to the north and east far beyond the bounds of his mineral estate. He did not want to trouble his hearers with anything that was merely personal and commercial, but he was sure they would pardon him for saying that not the least interesting feature of this discovery to him was that it had revealed the existence of from six to eight million tons of magnificent steam coal in his mineral estate that he had no expectation of having, and he could see clearly that for the next 50 to 100 years, at least, the collieries he worked could go on landing a large quantity of splendid coal, at a cost that would enable those who worked them to hold their ground against all competition, come from where it may, and thus continue to develop one of the important industries of the district. . . . . Proceeding to the source of the dislocating force, he said the Mendip Hills formed the southern boundary of the Bristol coal-field, though their distinguished president (Sir William Guise), Mr. Etheredge, and himself were able some two or three years ago to gather proofs from the rocks at Cannington Park, near Bridgwater, that those rocks, which had previously been regarded as Devonian Limestone, were after all the Carboniferous Limestone, though in a highly crystalline condition, and very sparse of fossil remains. Being, however, genuine mountain limestone they showed almost certainly the existence of a coal-field south of the Mendips. His object in referring to this was to recall their attention to a fact that was proved by their friend Mr. Etheredge, and the late Mr. Charles Moore, of Bath, beyond all question, namely, that the Mendips were lifted after the deposition of the coal measures—but prior to the deposition of the secondary rocks—and that when those hills were thrust up by the volcanic force that in some portions had pushed the lava right through the limestone and Old Red Sandstone, the whole country to the north, and possibly to the south as well, was thrust forward. At Radstock, five miles north of the Mendips, this thrust had given Lady Waldegrave a double quantity of the Radstock or upper series in veins. They must, however, look for the force that has thrust the Kingswood coal-field over itself at a nearer point than the Mendip Hills, and he thought if they would look at the enormous development of carboniferous limestone at Blackdown, Bourton, and in that district, they would see the seat of the force that has caused this displacement. It was singular and exceedingly interesting to note the effect of this thrust. If they looked at the map they would see that south of where they stood the river Avon has been pushed a mile to the north out of its natural course by the same force that had thrust the coal-field over itself, and he happened to know that two or three miles below the level course of the seam of coal in the coal-field had been turned almost at right angles to its regular course by the same upheaval of Carboniferous Limestone, and the displacement caused thereby and the level course of the workings on the south dip of the coal-field at Kingswood at a great depth, followed the remarkable course in the river to which he had called attention—thus showing pretty conclusively that the course which had caused the one had produced the other. The level course of the workings at the South Liberty of the Ashton Colliery had been turned round by the same course. In conclusion, Mr. Cossham remarked that the problem he had endeavoured to explain would have a very important influence on the future of the district, and was associated with an industry upon which the future of the country largely depended. Whenever England's mineral resources failed, her commercial supremacy must end, and therefore every discovery that widened the area and increased the extent of their mineral resources should be regarded with interest.

A PRACTICAL METHOD OF ESTIMATING DISTANCES.

DRAW one or more silhouettes of standing or kneeling men upon a card—the standing ones 25 mm. in height and the kneeling ones 16 mm. If you are an artist and have the means at disposal, instead of simply blackening the figures, you may paint both surfaces with the colours that are peculiar to the different uniforms of the enemy, but care must be taken not to lay the colours on too thin. Now cut the figures out with care, leaving sufficient paper attached to their bases to allow the instrument to be held between the thumb and first finger.

The apparatus being constructed, it only remains to use it. At 200 mètres distance station one or more men, and, where you are standing, allow an assistant to hold the instrument at the height you direct him to. Now proceed to a distance of exactly four paces, of 0·75 m. each, from your figures, and ascertain whether their general aspect, as regards height and width, corresponds to that of the men stationed 200 mètres off. If the resemblance is perfect, you are in possession of one of the simplest and most portable of telemeters; if it is not, you will have to begin all over again. You may renew the operation by placing your men at 300 mètres, and taking six paces instead of four (Fig. 1).

The arrangement adopted permits, on holding the instrument away from the eye, of diminishing the difficulty that the latter has of seeing the objective and image simultaneously. Besides, it lessens the trembling of the hand that holds the apparatus, and which would render observation impossible in an ordinary stadium placed at 0·6 m. from the eye.

What is the value of $\frac{H}{h}$? In the majority of proportional base telemeters the distance sought is 50 times greater than the base. Such a ratio is very convenient, since it necessitates a base of only 20 mètres for a distance of 1 kilomètre

Fig. 1.—Method of Estimating Distances.

Supposing that the apparatus has been constructed satisfactorily, the manner of using it for estimating distances will be readily understood. Let an assistant hold the instrument in the direction of the troop that serves as an objective, while you move backward in keeping your eye upon the silhouettes and the objective, and stopping when the figures and men exhibit the same aspect and seem to form part of one and the same group. Then returning to your assistant, you count the number of paces that separated your eye from his hand. Upon multiplying this number by 50, you will obtain a product that will give you in mètres the distance sought.

Notwithstanding the wonderful simplicity of the instrument, it is easy to control the accuracy of the principle upon which it is based, first, by reasoning, and then by experiment.

In the similar triangles, A B C and D E C (Fig. 3), we have the ratio:

$$(a) \qquad x = l\frac{H}{h}$$

H and h being constants, l will have to vary with x, that is to say, with the distance.

However, as the observer can scarcely measure the base otherwise than by pacing it off, it has seemed preferable, in order to expedite the operation and avoid a conversion of pace measurements into mètre ones, to take a mean pace of 0·75 m. as unity, and to modify the formula so as to at once obtain the distance in mètres.

In formula a, on substituting $n \times 0{\cdot}75$ for l, and making $\frac{H}{h} \times 0{\cdot}75 = 50$ (H being equal to 1,665) we shall have 0·249 m. as the value of h.

If, however, greater precision were required in the results, the mètre might be preserved as the unity of measurement of the base, the silhouettes be given a height of 33 millimètres, and a cord about 30 mètres, with knots 1 mètre apart, be employed. But it will be readily understood that this process, although more accurate, is much less practical.

Let us now examine the causes of error, as well as their limits.

The height of a soldier, taken as a base, varies between 1·45 m. and 1·8 m. As the mean height generally admitted is 1·665 m., we should, upon taking this as a basis

and operating upon extreme heights, commit an error of about one-thirteenth, more or less, of the distance sought. But if, besides the height, we consider (and it is the case here) the breadth of several men, we see that this dimension has less variation, and that we could not assign to the error a value of more than one-fourteenth. This might, moreover, be sensibly reduced by means of operations repeated upon different subjects.

Another cause of error is due to the manner of doing the pacing, which may vary from 0·7 m. to 0·8 m. at the most when some little attention is paid to it, or 0·05 m., more or less, than the normal pace. But the error committed in this case will represent only one thirty-fifth, more or less, of the distance sought, and this may be thrown entirely out of consideration when regulating firing is concerned. The two errors, upon being added, will, at the worst, never give a deviation of more than one-tenth in the real distance, and we shall admit that such an approximation is sufficiently exact if we reflect upon the gross errors that we should commit in estimating by eye, and upon the great variations in range that occur in the best-regulated firing.

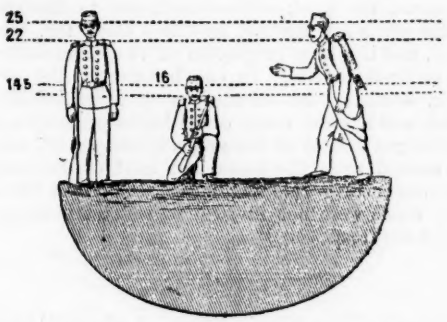


Fig. 2.—Apparatus for Estimating Distances (actual size).

Let us add, that with this instrument it is not necessary to see the entire object; if the upper part of a man's body can be seen, it will be sufficient.

In clear weather this process can be applied to distances of 1,000 mètres and beyond; but if there is a field-glass at one's disposal, it will be preferable to use it for very long distances. In all cases it is well to light the image as much as possible in the same manner as the men observed. If, for example, these latter were in shadow and the instrument were too brightly lighted, it would be necessary to

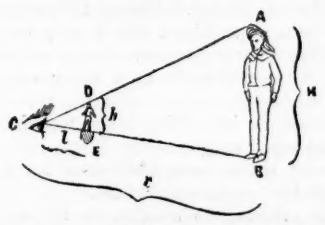


Fig. 3.—Apparatus for Estimating Distances.

cut off with the hand or cap the solar rays that were falling thereupon.

It resulted from experiments made at Fort Cagnelot, on the Langre plateau, that, out of thirty measurements, one only could be considered as insufficient, this having given an error of at least one-eighth of the distance. All the rest showed a deviation much less than that which had been fixed on as a limit; and, if a mean of such deviations be sought, it will be found that it was only one twenty-second. The little instrument that we have just described has in nowise the pretension to replace those excellent telemeters that all infantry corps are provided with; but it offers a sure and convenient means of estimating distances, and we believe that a frequent use of it will quickly familiarize the observer with making such estimates by the unaided eye, and this, it should not be forgotten, will always be the most really practical method on the field of battle.—*La Nature.*

PLEASANT HOURS WITH THE MICROSCOPE.

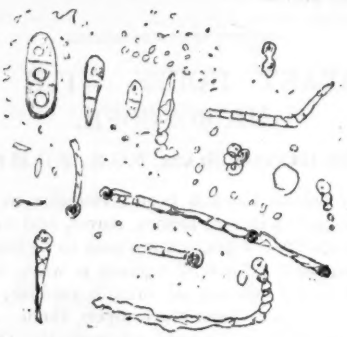
By Henry J. Slack, F.G.S., F.R.M.S.

THE dry season has not been favourable to the growth of fungi, but in cool houses, stoves, and out of doors, some of the gardener's plagues are sure to be found. Here, for example, is a plum-tree against a wall, with leaves looking as if all manner of minute rubbish, plentifully mixed with soot, had been stuck upon them. An inspection with a hand-glass shows amongst the smut-patches numerous cast skins of aphides; here and there a small, live object—the so-called red spider, which is a mite—and some scale-bugs. So little of the leaf is left in its natural state that all its functions must be suspended. If an orange-tree is examined, some of its leaves will most likely exhibit similar dark spots. Geraniums in a cool house may here and there have on their leaves the same sort of sooty stuff, and ferns are not infrequently attacked. The only thing to be done for the health of the plants is to wash all the objectionable stuff off with soap-and-water, or the Gishurst compound—a sulphur soap. If the leaves of any plant exudes honey-dew, or that substance deposited by aphides, black fungi are pretty sure to grow; but leaves are often covered with them when no particular reason can be detected why they should be assailed.

If a bit of infected leaf is viewed under the microscope, as an opaque object, small tufts may be discovered, looking less black than they appear to the naked eye. They are composed of thread-like tubes and spores of various shapes, which are translucent enough to transmit some rays of brownish or sometimes olivaceous light. A little of the black stuff may be removed with a pen-knife placed in a drop of water on a glass slide, and spread out by moving a covered glass over it. The annexed figures represent the miscellaneous objects likely to meet the view. It is hopeless for any one not well practised in fungology to name these things with proper discrimination, and great authorities like Berkeley or Cooke would not pronounce upon some except after carefully cultivating them, and seeing what they should do. The old authors called the black stuff *Cladosporium fumago*, but Dr. Cooke tells us it is now usually named *Fumago varians*, and that it is considered a conidial stage of Caprodium. If the inquirer examines these things under a microscope, and compares what he sees with the drawings and descriptions of the fungologists, he will think they might be taken for *Helminthosporium*, *Cladosporium*, *Macrosporium*, and *Sporidisinium*.

What is remarkable, and of great though puzzling interest, is the variety of forms under which fungi of the same species can carry on their life processes. In the aggregate, a prodigious amount of work is done by fungi of the minuter kinds. They and their relations—bacteria, &c.—

preside over the disintegrating processes of decay and putrefaction. Their spores abound in the air of towns, and in rural places that are not very high above the sea level and remote from sources of contamination. Their adaptation to various conditions of heat, cold, moisture, dryness, rich or poor supply of appropriate food, &c., is obtained by their power of modifying their growth according to circumstances to an extent quite unknown amongst the higher plants. In



the group of objects in the sketch some are spores of different shapes, some naked, some in little bags (*asci*). The tubular threads are the mycelium which produces them. There are also numbers of extremely minute round objects, which are no doubt capable of starting fresh growths. A fungus spore may be a single cell growing out of a spicular or a thread-like support; or it may be produced in an *ascus*, or sporange (spore vessel), or be in a dust-like condition, *conidia* (secondary spores).

What is a spore? This question requires a rather elaborate answer, and, in reply, it is perhaps best to explain what seed is in the higher plants. In the phanerogams, or plants which show distinct sexual organs, pollen-bearing anthers, pistils, and ovaries, the seed is the result of pollen action upon a plant egg, or ovule. This seed produces a plant like the parent by apparently direct growth. If we look to the spore of one of the higher vascular cryptogams —say a fern—its first visible process of development is a little expansion called a *prothallium*, and then comes the growth of sexual organs, and their concurrence to give rise to a new plant. Vegetable physiologists trace resemblance between pollen grains and spores, and Sachs tells us that "the fertilised embryonic vesicle of phanerogams is not directly developed into the embryo; it first of all produces a pro-embryo, the *suspensor* growing towards the base of the embryosac, and dividing, and on the apex of which arises a mass of tissues from which the embryo is developed." To a beginner this will seem rather obscure, but what it means is this: that the plan of nature is similar and continuous from lower to higher forms, and there is no impassable gap between the growth of a spot of mould upon stale paste and the reproduction of an oak from an acorn its parents made. Besides spores which are adapted to immediate development, fungi produces resting spores, which can wait uninjured for another season, and the dust-like conidia are, in many cases at least, able to withstand prolonged drought. "The same species," observes Berkeley, "may at different times have simple, uniseptate, or multiseptate fruit, and its form will vary in different *asci* of the same individual, though some general characters may be exhibited by all."

To determine the species of a fungus accurately, it is necessary to know it in all its forms, which, in a great many cases, no one has succeeded in doing, and the number of real species is probably only a fraction of those mentioned in the books. The modes of reproduction of fungi are very various, but Sachs informs us that in those species whose cycle of development is fully known, either sexual reproduction, or conjugation—a form of it—always occurs, and in those cases where neither of these processes has been observed, it may be assumed that their life history is incomplete.

The black fungi which more immediately concern us, are often terribly destructive when they attack orange and coffee plantations, and have caused most serious losses in Ceylon and the Azores. In Europe, they often ruin the olive crop. With a few plants to care for, the plan of washing each leaf can be adopted, but the owner of an estate on which thousands are grown is in a helpless condition. These black plagues are not strictly parasites, as many of their relatives are. If a slightly or newly-affected orange-leaf, for example, is carefully washed, and then examined under the microscope, its surface will be found uninjured, and if the cleaning is done in time, the plant is not damaged, and the leaf fulfils its functions as before. If, however, the black mildew is allowed to flourish and cover the whole leaf surface, as with a black felt, the leaf is killed, and if a large proportion of the leaves suffer, the plant may not recover. In one instance in the writer's grounds, a small bush of the bay (*Laurus nobilis*) was attacked and a great many of its leaves partially covered by the fungus. Most of it was gently scraped off, and the shrub seemed none the worse, but most of the branches died in the ensuing cold winter, while others of the same species, which were not invaded by the black enemy, did not mind the frost.

PHOTOGRAPHY FOR AMATEURS.

THE question of popularising photography being now prominently before the public, we propose to offer a few remarks bearing thereon, premising that the subject is one in which many of our readers may be interested.

Less than half a century ago the art of photography was regarded, by all but the very few initiated into the secret of its working, as being little short of magic; and although, by the improvements it has undergone from time to time it has to a certain extent become familiarised with many, it nevertheless continued to be regarded as an "art and mystery" by a great majority of the public until within the last decade. During this period, however, a change has been experienced which may be pronounced as little less than a revolution,—a change which has placed photography in the first rank as a study and an amusement. Its value as an aid to scientific research has long since been conceded; but owing to the technical difficulties in working the old "wet" process, it has, till within comparatively recent times, been little used for this purpose except through the professional artist.

The change referred to consists in the substitution of "dry" for wet plates in producing the negatives; and in order that those of our readers who are unacquainted with the methods may understand the full significance of this improvement, we will endeavour to give a rapid contrast of the two processes, though considerations of space prevent us from entering on a detailed description.

By the wet process the amateur desirous of practising, say, landscape photography, would have to carry about with him quite a laboratory of chemicals, requiring very delicate handling; and if the size of the intended picture

were to exceed the meanest proportions, the carriage of the necessary materials, by reason of their weight and bulk, would constitute a potent antidote to the pleasure that might be otherwise obtainable. And even were the amateur artist to overcome the difficulties of transport, his troubles would be still considerable, for his wet plate requires the most exact and careful manipulation, or, notwithstanding all the pains taken in its preparation, it would be absolutely useless for the purpose intended. Another objection to wet-plate photography consisted in the destructive nature of the chemicals used in preparing the "bath." The would-be artist of fifteen years ago was far more likely to be successful in staining his hands and his clothes —the latter beyond recovery—than in producing a picture worthy of the name.

All this has been changed since the introduction of the dry-plate process. The plates can now be purchased ready prepared; all "bath" troubles are dispensed with; cleanliness in working is secured; and the amateur can start on his photographing expedition carrying his whole apparatus in one hand (unless he be unusually ambitious as to the size of his picture), with the certainty of producing far better results than by the discarded process.

This simplification of the method has, of course, done much towards rendering photography popular, not only as a study for amateurs, but also as a cultivated amusement. With the pleasure-tourist the art is already in great favour; it is self-evident that the pleasures of travel may be greatly enhanced when one is in possession of the means of easily photographing the various places of interest visited. We say easily, for by the new dry process the plate does not require immediate "development;" after the negative has been taken it may be put aside, and the picture can be developed with perfect success months after the plate has been "exposed." We number amongst our acquaintances an amateur who, though he spends much of his time in travelling both by land and sea, invariably takes his apparatus with him. The result is that he possesses an interesting collection of pictures taken by himself in different parts of the world; and many a pleasant evening has been passed in contemplating them and chatting over the reminiscences they recall.

We believe that ere long photography will be generally regarded as a ready and pleasant dissipator of the *ennui* sometimes attending a prolonged residence in the country. Indeed, we will go so far as to say that a set of photographic apparatus should be considered to be an almost necessary adjunct to every country house; to lady visitors especially would such afford the means of amusement, now that the process has been divested of its objectionable features—an hour or so with the camera could hardly fail to prove a welcome relief to the sport of "killing time" so often perforce resorted to by the fair sex when away from the "busy haunts of men." Could aught be more enjoyable, for instance, than to be able to reproduce the glories of favourite scenery, and not only to reproduce them, but to easily multiply such reproductions for distribution, maybe, amongst an unlimited circle of friends? Again, in a lesser degree, perhaps, personal pleasure may be found in photographing one's house, gardens, servants, or domestic pets. All objects, animate or inanimate, are easy subjects for treatment by the new process, and in a thousand ways—trivial as these may appear at first sight—would a knowledge of the art be a source of pleasure and profit, not only to country residents, but also to dwellers in cities. So apparent is this to any one who take will the trouble to consider the matter, that we need not further enlarge on this portion of our subject.

Granting, then, that photography *is* an art to be cultivated for amusement, or as an aid to the student, the next question to consider is the best means of becoming conversant with the process. And, in the first place, we would advise the intending student not to rely only upon the perusal of text-books, for although many of these undoubtedly contain much information on the subject, the untutored beginner will rarely succeed in eliciting from them the real *practical* instruction which is necessary. Personal instruction is, in our opinion, essential to the complete understanding of the process; although the *technique* of the art is now so simple that but little time need be expended in acquiring a fair knowledge of it by a person of average intelligence. The London Stereoscopic Company, by the way, seeing the force of this argument, are now giving gratuitous instruction to purchasers of their apparatus, at their studios, 110, Regent-street, W. We are ourselves able to testify to the thoroughness of their system of teaching, and the world-wide renown the Company enjoys is quite sufficient guarantee of the quality of their instruments, which are, it is only fair to mention, marvels of compactness, and, furthermore, may be purchased at but little cost. The lessons are conducted privately and individually, palpably a great advantage to the learner; while the studios are comfortably appointed, and, what is of far more importance, excellently provided as to light. Intending students resident in the country may, if they prefer it, receive instruction at their own homes, thereby avoiding the inconvenience sometimes attending a journey to town, for the Company are prepared to send, by arrangement, a competent instructor to any given address; this plan would also afford to those desiring it the opportunity of acquiring, at the same time, skilled professional assistance in photographing such objects in their own neighbourhood as might possess for them special interest.

In conclusion, we may say that, considering the many advantages to be derived from the study of photography for pleasure, the comparatively insignificant outlay of time and money involved in its acquirement, the cleanliness and simplicity now secured in working, and the facilities offered —as above mentioned—to the public as regards tuition, it would be surprising if what has been called "the black art" (presumably in reference to the suggested mystery attaching to it, but with more reason in sarcastic allusion to the dirty nature of its manipulation when the wet process was in vogue) does not become, at an early date, a first favourite amongst the amusements of the time.

Cork Bricks.—A composition of cork, sand, and lime moulded into bricks is now being tried in Germany for building light partition walls. It is said to have the advantage of excluding sounds better than ordinary brickwork, while being light and a good non-conductor.—*Engineering.*

The Commercial Aspect of Cholera.—The diversion of tourists from the Continent to English holiday resorts this year must be bringing an immense harvest to the inhabitants of the latter. One leading bank estimates the falling-off in the number of its circular notes issued this year, so far, at 3,000. At an average of £66 each note this would be £200,000, and if multiplied by fifty, to get at the approximate similar decline among other English banks issuing such notes, we get already a total of ten millions less to be expended this year by tourists on the Continent, without taking into account the numbers who never make use of circular notes, but usually take Bank of England notes and British coin for exchange into foreign money as soon as they cross the Channel. It must not be supposed that all the money restrained from flowing to the Continent is spent here instead, a great many families being probably glad of the excuse presented by the cholera to stay quietly at home and economise; but, anyhow considered, the saving to the country this year by reduced tourist expenditure abroad is probably thirty millions sterling or so, which ought to materially assist the good harvest in adding to the national accumulations of capital.—*Daily News.*

XUM

Editorial Gossip.

Another illustration of gross superstition reaches me: this time from across the Channel. In *La Petite République Française* for August 10, I read an announcement, that some pious pupils at a school having forwarded five francs to an establishment of the Sacred Heart, had been prayed for and passed their examination with flying colours. Appended to this are testimonials conceived in the true "Pills and Ointment" style. One from a young lady (seemingly well on her way to a lunatic asylum) would be ridiculous were it not positively pitiable and humiliating. After saying that she knew nothing and dreaded everything ("Je ne savais plus rien et je redoutais tout"), she goes on to attribute her success to having a statuette of Our Lady of the Sacred Heart in her hand or by her side during the whole of the oral and written examinations. Rude people may, perchance, attribute the success of these pupils to something approaching collusion between the examiners and the knaves who defraud these poor girls of their 5 f. pieces. If, however, this explanation be not accepted, and a candidate for examination has nothing to do but to hold a statuette in his (or her) hand to pass it, the plaster image trade about Hatton-garden ought speedily to revive and flourish hugely, while Professor Loisette will have to look to his laurels.

Every true student of astronomy must learn with sincere gratification of the continued success of that most practical working association, the Liverpool Astronomical Society. From its third annual report I learn that during the year ending August 16, 114 fresh members and associates were elected; and that the Society has during the same period issued 114 pages of printed matter, illustrated by 16 plates. The list of officers for the ensuing year could hardly be improved upon; while it is instructive to note that, out of a total expenditure of £72, 32 *shillings* (!) has gone for purely local expenses. It is hard to avoid a comparison between such trading on science as this on the part of the local authorities proper of the Liverpool society, and the beautiful disinterestedness and self-abnegation of certain gentry at Brompton!

If we may believe all we read in the French newspapers, the problem of aërial navigation has been solved by Captains Renards and Krebs in the very way in which we have been assured by experts that it was hopeless to attempt it; that is, by directing a balloon, with all its enormous resisting surface. I seem to remember reading an essay by the late Dr. Lardner, published in the days of our fathers, in which he demonstrated the physical impossibility of a steamer crossing the Atlantic.

The prediction of M. Ch. Montigny, of Brussels, that the present summer would be a very dry one—a prediction founded on his observations of the change in the character of stellar scintillation—has been fulfilled *au pied de la lettre*. Apparently, the scintillometer affords a rather more trustworthy method of meteorological vaticination than the quack method of sun-spot watching.

I have just got a new adjective out of the *Mirror of American Sports*, which will last me for some time to come. A performer on roller-skates is called "a Zampilirationistic artist"! How's that, Umpire?

Sir W. Parker Snow sends me a stirring Appeal to the English Nation to equip yet one more Arctic Expedition, and to place him in command of it; pledging himself to conduct it safely to the actual North Pole of the earth. In the face of the ghastly series of records of failure, culminating in that of the appalling sufferings of Greely and his band of fellow-explorers, I can conceive of no possible advantage, religious, social, commercial, or scientific, to be gained by the exposure of yet another company of brave and devoted men to imminent death and destruction, in order that they may (in the incredible event of their reaching their destination) be able to *say* that they have stood over the extremity of the earth's axis of rotation. For surely no other result than this could accrue; and, knowing from bitter experience at what an awful risk it must be achieved, I cannot consent to aid any attempt to effect it. Le jeu ne vaut pas la chandelle.

THE FACE OF THE SKY.

From August 29th to September 12th.

By F.R.A.S.

The student will keep, as far as may be, his daily watch on the Sun for spots and faculæ. He will find the night sky portrayed on Map IX. of "The Stars in their Seasons." There will be minima of Algol ("The Stars in their Seasons," Map I.) at 1h. 3m. a.m. on Sept. 5, and at 9h. 51m. p.m. on the 7th. Two other minima occur at such inconvenient hours during the next fortnight as to need no mention here. Mercury is an evening star during the whole of the succeeding fortnight, but can scarcely be picked up by the observer unprovided with an equatorially-mounted telescope. Venus is a morning star, and is a most brilliant and conspicuous object before sunrise, presenting the appearance, under proper optical aid, of the Moon when she is between twenty-two and twenty-three days old. Mars is invisible for the purpose of the observer, a remark which applies to Jupiter too; but Saturn rises soon after half-past ten o'clock at night at the beginning of September, and before ten p.m. when these notes terminate. He will be found a little to the north of ζ Tauri ("The Stars in their Seasons," Map I.), and, with his rings nearly as wide open as they can be, forms a glorious object in the telescope. Neither Uranus nor Neptune is fairly visible just now. The Moon will be full rather more than an hour before noon on Sept. 5, so that she will be visible during the first half of the fortnight which our notes cover. She has, though, too great south declination during the major part of this week to be scrutinised in the telescope to any great advantage. Two occultations only will occur at convenient hours during our specified period. The first is of the 6½th mag. star 11 Piscium, which on the night of Sept. 5 will disappear at the Moon's bright limb 4 min. after midnight, at an angle from her vertex of 117°. It will reappear at her opposite limb at 19 min. after 1 a.m. on the 6th, at a vertical angle of 301°. The next occultation will happen on the 12th, when the Moon will already have occulted BAC 1930, another star of the 6½th magnitude, before she rises. Later, however, at 11h. 14m. p.m., the star may be seen to reappear at her dark limb at an angle from her vertex of 220°. The Moon is in Ophiuchus to-day and to-night, leaving that constellation for Sagittarius to-morrow at 1 p.m. It takes her until 2 o'clock in the morning of Sept. 2 to cross Sagittarius and enter Capricornus, across the northern part of which she has travelled by 7 o'clock the same evening, at which hour she crosses into Aquarius. She quits Aquarius for Pisces at 6 p.m. on the 5th, and occupies until 4 p.m. on the 8th in traversing this great constellation. At that hour she enters Aries, which she leaves at 7h. 30m. on the morning of the 10th for Taurus. She is travelling through Taurus until 7 p.m. on Sept. 12, and she then crosses into the extreme northern part of Orion. As it is 6 o'clock in the morning of Sept. 13 before she emerges from the narrow strip of Orion into Gemini. We there leave her.

To Cleanse Laboratory Vessels.—*Dinglers' Journal* says that flasks which have contained oil or fatty matter may be easily cleansed by a solution of permanganate of potash. Hydrated peroxide of manganese is formed, which, on addition of strong hydrochloric acid, liberates chlorine. This decomposes the organic matter, and allows of washing with water. When the flasks have held resinous solutions it is necessary to wash with a caustic alkaline lye, and afterwards to rinse with alcohol. To remove turpentine, petroleum, photogene, &c., wash with thirty or forty grammes of sulphuric acid and rinse thoroughly in a stream of water.

Reviews.

Introduction to Science Note Book. By C. H. Hinton, B.A. (London: John Haddon & Co. 1884.)—The Science Note Book is a kind of copybook ruled in squares of various sizes. In his "Introduction" Mr. Hinton shows how the rudiments of Co-ordinate Geometry, Mensuration, and various facts of size, shape, and number may be taught in the most simple way. The idea is a good one, and the system well adapted for teaching the Elements of Mathematics.

The Elements of Euclid. Books I. to VI. By J. Sturgeon Mackay, M.A., F.R.S.E. (London: W. & R. Chambers. 1884.)—Following, to a great extent, Simson's editions of Euclid, Mr. Mackay has not done so slavishly; and in certain respects has improved upon that time-honoured editor of the immortal "Elements." His alterations are certainly, so far as we have tested them, all in the direction of perspicuity; and are calculated to remove those little difficulties which beset the incipient efforts of the student of geometry. The figures are capital.

Picturesque Wales. By Godfrey Turner. (London: W. J. Adams & Co.)—This very cheap, readable, and prettily-illustrated description of the various points of beauty and interest accessible by the Cambrian railways may be advantageously studied by those who, declining to subject themselves to the untold miseries of Continental quarantine, are ignorant of the wealth of glorious scenery to be enjoyed in their own country. The tourist, undecided where to spend his holiday, may invest sixpence in Mr. Turner's little book very profitably indeed.

The Moselle, from the Battlefields to the Rhine; Tourists' Travel Talk. Holiday Handbooks. (London: 125, Fleet-street.)—If, however, undismayed by foreign sanitary regulations, the traveller should determine to quit his own country in search of health and change, he will find all needful information as to the best means and cost of visiting the theatre of the Franco-German War and the glorious scenery of the Moselle generally in the first *brochure* whose title heads this notice. The second should enable him to make himself sufficiently intelligible to get about.

Expository Thoughts on the Creation. By James Robert Smith. (London: Printed for the Author by Elliot Stock.)—In the preface to the mass of hopeless nonsense whose title heads this notice, its author deprecates adverse criticism, on the somewhat incoherent grounds that it was written "when the writer was but temporarily engaged in his calling;" that "neither *leisure* nor *learning* (properly so-called) has been brought to bear upon it," that the "life-experience" of its writer "has been mainly gained in another and far different sphere—viz., in a department of the *legal* world," and "to a consequent lack of sufficient knowledge of natural history and other branches of learning and research." It is really difficult or impossible to conceive the mental condition of a writer who can put forward his ignorance of a subject on which he presumes to attempt to instruct others as a reason why such an attempt should be tenderly dealt with! For ourselves, we refuse to accept such an utterly irrelevant excuse. The inexorable rule which excludes the discussion of all purely theological subjects from these columns, prevents us from referring to Mr. Smith's polytheistic exordium: let us then see what his Science (Heaven save the mark!) is like: In limine he adopts the fifty times exploded idea that the "day" of Genesis "is age or era"; ignoring wholly that "the evening and the morning were the first (and each succeeding) day," and calmly putting Exodus xx. 8, 9, 10, and 11, out of sight altogether. However, having got his "ages or eras," let us see what our author does with them. Prior to the commencement of the first, the female Deity, by a "corporeal act," originated the compound elements of nature, "which were . . . . five in number—viz., aëriform vesicular matter, wind, watery vesicular matter, oleaginous vesicular matter, and salt." Then the wind, salt, &c., "began moving and rotating." Globules were poised in space, the air, at first thin, became thick, "the sea began to be developed," and "by virtue of the generating elements composing it, and those of air, being in constant and two-fold motion, there gradually started into being multitudes of animalculæ and microscopic life." With this "start" the transition to shell-fish and "many marine creatures . . . . who attained unto immense size," presents no difficulty at all—or, at all events, as little as the method in which their deposits formed "at last by far the greater portion of the *earliest* earth-crust—namely *that* composed of chalk and lime." Geologists and Palæontologists will be as interested to hear that Icthyosauri, Plesiosauri, and Megatheria (!) existed during the "third age" (or day) as physicists will that "the air was formed by the aggregation of innumerable globules or vesicles . . . . consisting principally of aëriform unctuous matter and watery unctuous matter"; or zoologists, that the same third day witnessed the creation of the penguin, petrel, dinornis, kestrel-hawk, sparrow, and red-pole. It will also, in all probability, be new to mineralogists to learn that during the fourth day (or age) there was a "*lead* formation in the northern hemisphere," and the "formation of *tin* in the southern; but that subsequently, on the fifth day (or age), there was "a *copper* formation in the northern hemisphere," and a *brass!!!* one in the south. "Pig-iron and dense iron," by the bye, came into existence on the sixth day. The generation of Adam "*solely* by a female gorilla," after all this, will scarcely cause any surprise. We would rather not trust ourselves to describe the genesis of Eve, as set forth by our author. At first sight it may appear that an apology is really due to the reader for occupying his time with such trash as that from which we have culled a very few specimens; but we have done so in order to show where the latest attempt at reconciliation between the irrefragable facts of natural and physical science and the legend in Genesis lands us. The harm to religion done by those who have, so far, essayed to effect this "reconciliation" can hardly be over-estimated. To address advice to the author of a book such as that on which we are commenting, can scarcely be anything but a waste of time. Inasmuch, however, as he seems to pay great deference to texts (with which his earlier pages bristle), we would urge that he should read, mark, learn, and inwardly digest Matthew xv., 14 v. as soon as may be.

Messrs. Hodder & Stoughton send us, under the title of *Health Studies*, a reprint, in three separate shilling volumes, of Dr. Paterson's work, of which we were able to speak so favourably in p. 461 of our last volume.

We have received from Messrs. Cassell & Co. the current parts of *European Butterflies and Moths*, *Cassell's Household Guide*, *Cassell's Popular Gardening*, *The Book of Health*, the *Library of English Literature*, and the *Countries of the World*, each and all of which are as pleasant to the eye as they are profitable to the various classes of readers whom they severally especially address.

We have also on our table *Le Franklin*, *Bradstreets*, *The Tricyclist*, *Naturen*, *The Australian*, *Society*, *The Medical Press and Circular*, *The Medico-Legal Journal*, *Ciel et Terre*, *The American Druggist*, *The Dyer*, *The Factory News*, *The American Naturalist*, *Sunday Talk*, *Our Monthly* (published in Rangoon), and *The Hindu Excelsior Magazine*.

Miscellanea.

The *Lawrence American* of July 9 says:—For more than ten days past the entire power for running not only the large Hoe press upon which this paper is printed, but for the cylinder and job presses of the entire printing establishment, has been from electricity coming over a single wire from the dynamos, four blocks away.

The National Health Society have issued another of their admirable, timely little pamphlets, entitled "How to Prevent and Oppose the Cholera." Charitable people might make infinitely worse use of their money than by circulating this tract widely in poor and crowded neighbourhoods, which could be done at a very small cost.

Professor Hall, of the United States Naval Observatory at Washington, calls attention (in No. 2,602 of the *Astronomische Nachrichten*) to the necessity for a uniform catalogue of clock stars for general use. He suggests that it should be sufficiently elaborate to enable the apparent position of a star to be interpolated with ease and certainty for any given time. Its cost ought not to be great.

The following telegram from St. Petersburg appeared in Tuesday's *Standard*:—"The list of modern books which, according to the Decree of the 5th of January, are not to be allowed in the reading-rooms and public libraries of Russia, includes translations of works by Agassiz, Bagehot, Huxley, Zola, Lassalle, Lubbock, Lecky, Louis Blanc, Lewes, Lyall, Marx, Mill, Reclus, Adam Smith's 'Wealth of Nations,' and 'Theory of Moral Sentiments,' and Herbert Spencer's works."

The Smoke Nuisance in Glasgow.—At a meeting of the Town Council of Glasgow, held recently, the chief constable stated that the number of observations of chimney-stacks made by the police in Glasgow during the year 1883 was 1,312; that in 132 cases reports were made to the Procurator-Fiscal; that in 70 of those cases no proceedings were taken; and that in 25 cases the parties were tried and acquitted, while in 37 cases the parties were convicted.

The total cost of the Greely relief expedition is estimated by the officials of the Navy Department at about £140,000. The original estimate was £100,000. Of the amount expended, £50,000 was for supplies and £62,000 was for the purchase and repair of the steamships *Bear* and *Thetis*. The repairs made to the *Alert*, lent by the British Government, involved a cost of £3,033. Instruments for making observations cost £5,000, and the coaling charges came to £3,000.

The Panama Canal.—Considerable deliveries of plant have still to be made in connection with the Panama Canal works. Among this plant may be mentioned 1,500 trucks, 28 locomotives, 23 dredgers, 3 hopper barges, 25 portable steam-engines, 20 steam navvies, &c. Altogether plant has been ordered to the aggregate value of £1,400,000. The aggregate quantity of earth which has to be removed to render the canal available for navigation is 120,000,000 cubic mètres. Two-thirds of the earth thus to be excavated will be removed in a dry state, and the balance of one-third will be dredged.

We regret to announce that Mr. Henry George Bohn, the publisher, died at his residence, North-end House, Twickenham, on Friday, at the advanced age of eighty-eight. The son of a London bookseller, he was born in January, 1796, and, after completing his education, entered his father's business, where he soon acquired a knowledge of books which made him one of the best bibliographers of the age. In 1831 he commenced business on his own account, and it is impossible to estimate too highly the services he rendered to the more intelligent portion of the community by republishing, at a cheap rate, a vast number of the most valuable works in literature, science, philosophy, history, biography, topography, archæology, theology, natural history, poetry, art, and fiction. He retired from business some years since, when the whole of his stock passed into the hands of Messrs. George Bell & Sons.

A great stir is being made about the recent application at Berlin of a dynamo machine to operate about forty telegraph circuits. It appears to be regarded as a new and important departure. Presumably, sight is lost of the fact that thirteen years ago a gramme dynamo was in use in Telegraph-street supplying the current necessary for forty, and sometimes upwards of sixty, circuits, and was only allowed to pass out of use because a workman ran his file over the insulation, and so spoiled the machine. But what purpose can be served by such an experiment? It seems something like using a steam-hammer to crack a filbert. Thirty to forty London wires have been worked for months together from fifteen quart bichromate cells. The objection to working a great number of circuits from one source is that should that source fail, if only for two minutes, the whole of those circuits are stopped for a similar time, and the stoppage of a circuit for even two minutes is often a serious matter.

At this season alarm is expressed at the diminution of the water-supply of Paris, and the municipal bodies are in a hurry to deal with the question forthwith every year. But it is forgotten as soon as the drought is at an end. The volume of water in the reservoirs is again reported very low, and the waterworks are unable to yield at the present moment more than 378,000 cubic mètres per day, which is scarcely half the quantity considered necessary for the supply of Paris. In many quarters of Paris there is not a dwelling supplied with water. Water-closets, properly so called, are only to be found in the newest houses; and, as everybody knows, the system of sewage is behind the age, every Paris house being still supplied with a cesspool, which is emptied about once a year, and from which, from year's end to year's end, noxious gases ascend into the apartments, rendering, a *Times* correspondent says, the French metropolis a hotbed of typhoid fever.

Subsidence in Cheshire.—The demand for salt is now so great that the subsidences usually to be observed in the great Cheshire salt-fields are more apparent than ever, particularly at Northwich. These culminated recently in the settling down of a vast body of earth, upon which a boy in charge of a horse was standing. Both boy and horse were engulfed, and would have been killed but for the assistance speedily rendered by onlookers. In order to form some sort of an estimate of the quantity of brine extracted at Northwich and Winsford, it may be stated that the returns made up for last month show that the exports of salt were 127,998 tons, against 103,878 tons for July last year. Of this large quantity the East Indies took no less than 46,431 tons, and the United States 17,552 tons. The exports for July were, with one exception, the heaviest for any corresponding month for the past seven years.

Church-bells and Thunderstorms.—On July 5 last a violent thunderstorm, lasting three hours, occurred near Saintes, in the south-west of France. A poplar about sixty feet high and twenty inches in diameter at the foot was cut off quite clean and level, six feet above the ground. The rest of the tree was splintered into thousands of fragments, which resembled a wood-cutter's "waste," the largest weighing about thirty pounds, and the smallest mere chips. These lay evenly all round in a circle to a distance of 100 yards from the trunk. In that district the funny old superstition of ringing the church-bells during a thunderstorm as a lightning protector survives, and the dutiful old sacristan was ringing away as hard as he could at three o'clock in the morning, when, the steeple being about 300 yards from the poplar-tree, he was knocked down by the shock. Hearing the bells stop, the village population thought he was killed, and turned out in a body to find him more frightened than hurt.—*La Constitution* (of Cognac), July 11, 1884.

The Patent Office Report.—The first report of the Comptroller General of Patents, &c., under the new law has been issued. The most striking fact of the report is the record of the sudden pressure thrown upon the Patent Office during the first month of the year, when cheap patents became available. The applications during January numbered 2,499; whereas the previous average for the month was about 500. Not only was the number of applications increased fivefold, but the work on them was much heavier; for the provisional specifications were not merely pigeon-holed, as formerly, but were all examined, and in many instances amendments were introduced at the suggestion or by the requirement of the examiners. During the four months covered by the report the total number of applications made was 7,060. The expectations of those who imagined that the new law would dispense with agents are not justified by the facts; for 72 per cent. of the applications still pass through the hands of patent agents.

Solar Heat and Weather Change.—Mr. Slack writes on Saturday, Aug. 23:—"A black bulb vacuum thermometer, placed on the ground in a shallow box filled with cotton-wool, and black cotton-velvet under the bulb, registered 125° F. at 10h. 27m. a.m. A sensitive spiral thermometer, hung against a post of dark purple colour, rose a few minutes earlier to 104°. At 11h. 9m., B.B. 140°; 11h. 42m., S.T. 112°, and at 11h. 45m., 114°; 12h. 28m., B.B. 149°; 12h. 31m., S.T. 117°; 1h. 2m., B.B. 150½°. During this time a cool easterly wind was blowing. B.B. was in a sheltered place; S.T. more exposed. The two thermometers were then placed together on the cotton-wool and velvet, and at 1h. 40m. B.B. was at 152¾°, and S.T. 126°. On Sunday, the 24th, at 12h. 35m., B.B. 143°, S.T. 116°. At 1 o'clock, B.B. 145°, S.T. 118°; 1h. 40m., B.B. 152°, S.T. 123°; a cool wind was blowing. On the 23rd, at 1h. 54m., the temperature in shade was 75° with dry bulb of hygrometer, and 60° wet one. At 1h. 40m., on 24th, the two bulbs stood at 75° and 65°. On the 25th the weather changed, and at 1h. 15m. the two bulbs showed 62° and 60°. Ashdown Cottage, where the observations were made, is on the north slope of the Ashdown Forest range, and 406 feet above sea-level."

"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to delays arise for which the Editor is not responsible.

All Remittances, Cheques, and Post Office Orders should be made payable to Messrs. Wyman & Sons.

The Editor is not responsible for the opinions of correspondents.

No communications are answered by post, even though stamped and directed envelope be enclosed.

SUNFLOWERS.

[1371]—Mr. Grant Allen, in his article on "Sunflowers," mentions the scaly bracts which, he says, serve as a protection to the unopened flower-buds, but makes no reference to the secretion which appears at the apex of each of these bodies. Having had several sunflowers under my observation during the present season, I should like further information on the subject. What is the nature and purpose of the substance secreted? Is it gum?

Will the author of the article also answer the following questions for the benefit of the readers of Knowledge?—

What causes the contraction of the filaments which draw the united anthers within the tube of the corolla after the pollen has been shed?

What is the action of the style after fertilisation?

Robert Paulson.

VISIBILITY OF THE DIRECTION OF A FLASH OF LIGHTNING.

[1372]—Having just now read "The History of a Lightning Flash," which appeared in your issue of the 15th, I am induced to ask space in your columns for a narrative of facts which may possibly interest some of your readers. One day, about midsummer (in the year 1842), I was standing—along with four others who have since passed over to the majority—on the deck of a yacht, at no great distance from St. Anne's Head, Isle of Man, watching the progress of a thunderstorm, which had just before passed over our heads from the S.S.E., and from which our escape had been a narrow one. For some time nothing remarkable occurred; but ere long I suddenly called out, "Did you see that?" to which, with one voice, the answer was "Yes." And if it had not been "Yes," I should most certainly have disbelieved my own eyes, knowing well, as I did even then, that the eye is "a deceitful member—very." What then, think you, did we see? Simply the establishment of an electrical equilibrium between two clouds; but that was effected by a flash of lightning striking the top of South Barrule Hill (towards which the storm had passed from where we were), and rising out of that of Snaefell, which lay several miles towards the N.E., and so was not in the track of the storm. It is almost needless to add that from that moment to the present I have never doubted that the direction taken by a flash of lightning is perceptible to the sight; though, of course, others are at perfect liberty to think otherwise if they please.—W. A.

IS TEA INJURIOUS?

[1373]—Will Mr. Williams say whether he thinks tea may not be drunk in moderation (say two cups in the evening) with immunity, unless, indeed, the contrary only is to be inferred from his article ("Chemistry of Cookery," page 128). What are the effects produced by the use of the noxious herb and the symptoms of the mischief wrought? I enjoy my cup immensely, and experience all that Mr. Williams describes, especially the "fit for anything" condition, without, however, being aware of any ill effects (and is this without its value?), but would relinquish the habit (not without a pang) on the advice of so eminent an authority. With thanks in advance,

A. Gaubert.

THE PREVENTION OF SMALL-POX BY VACCINATION.

[1374]—The cases of salvation through vaccination in the extract from the *Medical Press and Circular* cited in Knowledge, give neither names, dates, nor any means of authentication, and, if correctly reported, may, I venture to say, prove nothing to the point. No opponent of State-enforced medical prescriptions believes that the omission of vaccination affords immunity against small-pox. What they maintain, however, is that there is no scientific evidence that vaccination affords such immunity. The recent devastating small-pox epidemics amongst the well-vaccinated populations in Sunderland, Liverpool, Birmingham, and London ought to settle the question to every unprejudiced mind; but the bulk of the population are not unprejudiced, and fail, therefore, to recognise the force of facts that run counter to popular theories. It may, however, interest some of your readers to learn that this important question has, during the past few years, been carefully investigated by a distinguished scientific observer, Dr. Alfred Russel Wallace, whose memoir on the subject is now in the press, and who summarises his conclusions as follows:—

1. That vaccination has not saved a single life; this not being an opinion, but a fact proclaimed by the Registrar-General's own facts and figures.

2. That vaccination does not diminish small-pox mortality—demonstrated by the same official facts, and by the record of small-pox deaths of our re-vaccinated and "thoroughly protected" soldiers and sailors.

3. That, while utterly powerless for good, vaccination is a certain cause of disease, and death in many cases, and is the probable and almost certain cause of about 10,000 deaths annually by five painful and disgusting diseases, which have increased to this extent since vaccination has been officially practised and enforced.

In the presence of such weighty testimony, it is surely not too much to ask the medical profession at whose instigation these compulsory laws have been enacted, to do what in them lies to retrace their steps, and to petition Parliament for their immediate abrogation. The Imperial Parliament of Germany, unable to resist the accumulation of testimony showing the futility of vaccination as a prophylactic, and its pernicious effects on the public health, has recently appointed an Imperial Medical Commission to investigate the question *de novo*. It may not be generally known that nine of the Swiss cantons have already abolished compulsory vaccination, with the result of an important diminution in infantile mortality.

William Tebb.

[I insert Mr. Tebb's letter in what he himself calls "the interests of public health and fair play"; albeit, his idea of "fair play" would seem to be the attribution of disingenuousness and moral perversity to all who differ from him. That the *Medical Press and Circular* may have suppressed names for fear of giving pain to the survivors of the unfortunate creatures whose lives were sacrificed to the Anti-vaccination craze, appears never to have occurred to him. No one who is not monomaniacal on the subject can shut his eyes to the patent fact of the immunity of the well-vaccinated officials of the small-pox hospitals from the fell disease with which they are surrounded. As for Dr. Alfred Russel Wallace's opinion on the subject, it must be taken *quantum valeat*. As a natural historian and as the independent co-discoverer with Darwin of evolution his name must command universal respect. As the author of "Miracles and Modern Spiritualism" he . . . but I do not wish to say anything hurtful or offensive of a man for whom I entertain both admiration and esteem. I have no more doubt that vaccination has saved hundreds of thousands of lives than I have that I am writing these lines.—Ed.]

SHIPS' LIGHTS.

[1375]—As a constant reader of Knowledge, your articles "Sent to the Bottom" have been to me, as all others always are, interesting as well as instructive. With regard to the lights you propose ships should carry, the opinion and ideas of one actually concerned in their importance may not be without value and significance to your readers.

In the first place, your plan appears to be open to one very serious objection—the lights would be too numerous about a ship's deck. I think all who follow the sea will agree with me that the fewer lights carried, and the more simple their disposition is made, the better. No method of placing lights on board ship is absolutely safe, except in the iron lighthouses now in great use in steamers. The exposure in other cases often causes their total extinction by a heavy sea at a critical moment; and your plan would require six lights, three on each side, the lighthouses for which would be too much in the way of working ship. Again, in narrow channels crowded with shipping, the multiplicity of lights would be simply bewildering. Your remarks about fixing the fine, parallel threads

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equidistantly in a small diaphragm at the focus of a telescope's eye-piece might answer very well in fine weather; but, recollect, sir, that such weather does not always prevail; nor is the ship at all times steady enough to use a telescope thus fitted. In fact, there are really such bad nights, when it is blowing and raining hard, and sprays are drenching the ship fore and aft, when glasses cannot be used at all, and we must trust to our own unaided powers of sight.

Experience has taught me that the plan suggested by "J. H. G." of carrying a white light under a coloured one has this objection, that the white light outshines the coloured one. I have often observed, when meeting steamers at sea by night, a white light placed in a position where I expected to see the coloured one, and which ought not to have been there at all, shining so brightly that I could not detect the presence of the coloured one above it till nearly abreast of the steamer, and at no great distance from her.

With your correspondent "Chas. Rice's" plan, we could not tell which side of the ship was presented to us, as the lights on each side, when seen from before the beam, would be all of the same colour.

I think the lights as at present carried by ships, with the addition I will presently name, would answer the purpose, and all others should be effectually screened or put out, so that they might not be misleading, perhaps fatally so.

Many of your readers know that the lights carried by sailing vessels are a red light on the port or left side, and a green one on the starboard or right side, each visible over an arc of ten points, or 112° 30′, from right ahead. Steam vessels carry a white light on the foremast head as well, visible over double this arc—that is, from right ahead to 112° 30′ on each side. The addition I would make is to have two red lights placed vertically about six feet apart, and about ten feet lower than the white light of steamers, and on the after part of the after-mast, or in some such prominent position, visible through an arc of fourteen points, or 159° 30′—that is from right astern to seven points on each side, thus overlapping the other lights, and all being visible together through one point, or 11° 15′. The two vertical red lights to be carried in both steam and sailing vessels, and by means of which we could always see when we were overtaking another vessel.

I may inform your readers that as soon as a ship's light is seen at sea, its direction and colour will always show whether it is on the danger side of the observer, and the plan always adopted when first seen of taking its bearing, and a few minutes afterwards taking another, and noting the difference (if any) will show which ship is crossing the other; if there is no difference, it shows the ships are meeting, and there are proper rules by which one gives way while the other holds her course, and we never aim at passing as close as two hansom cabs in a street.

It is always the practice, as well as the constantly-repeated order, to give all vessels seen, especially at night, a wide berth. A vigilant look-out carefully kept by the officer of the watch, as well as those two most excellent qualities, a clear comprehension and a ready resource, will, in all cases where appliances are not faulty and the atmosphere fairly clear, keep any ship from collision with another. It is further greatly to be desired that under equal conditions all ships' lights should be visible the same distance.

There is also great need of distinction between the lights carried by disabled ships and telegraph ships laying or repairing telegraph cables. There being none at present, other ships are often taken miles out of their course to find, instead of a ship in distress, a telegraph ship at work.

The three red vertical lights visible all round the horizon, and which are carried in the place of the white masthead light, in telegraph ships at work might be changed to white.

The light carried by a sailing pilot vessel is the same as that of a ship at anchor, so that it is difficult at times to tell in what direction the pilot-vessel is going; it should be made obligatory to carry the red and green lights on each side, the two red vertical lights astern, and in addition, a red, white, and green light at the masthead, separated about six feet from each other, and visible all round the horizon, as well as to use the flare-up light as at present, which latter would show when they were on station with pilots aboard.

A British Shipmaster.

THE SPECTROSCOPE AND WEATHER FORECASTING.

[1376]—Not long ago I invested in a Grace's Spectroscope, being fond of the study of meteorology, and anxious to prove for myself the accuracy of the accounts given in Knowledge relative to the interesting instrument, and its power of predicting rain. My object in writing this note to you is to state my gratitude to Knowledge for introducing the Spectroscope to me as an aid in the prediction of the weather. I have effectually proved the importance and reliability of the instrument by this time. The following instance of its validity is so conclusive that I venture to inform you of it.

A few days ago the weather was very unsettled here (as it still is), and there had been much rain in the early part of a certain day; towards evening, however, it cleared up a little, but on asking the keepers, gillies, and sailors about what they thought the morrow would be like, they all agreed in saying there would be "a lump o' rain." The glass was falling, wind was N.W. I then referred to my Spectroscope, and was much surprised by its appearance, which only showed an extremely faint rain-band. So confident was I of my instrument, that in spite of disagreeing with all the weather-wise people of the neighbourhood, I predicted there would be *no* rain for forty-eight hours, and I proved, or rather the Spectroscope was, quite correct; not a drop of rain did we have, though the weather continued to be most unsettled, and the aspect of the sky very threatening. I may venture to say that the people (natives) about here (contrary to custom) are very weather-wise, and are seldom out to any extent in their judgments.

County Antrim, Ireland. H. M. McI.

AUGUST METEORS.

[1377]—Several meteors were observed here on the 11th, between 10h. 15m., and 12h. p.m. Attention was directed almost exclusively to the constellations Cassiopeia and Perseus, no attempt being made, except in two instances, at estimating the duration of visibility. The first, seen at 10h. 23m., surpassed all subsequent ones in brilliancy. It emanated from right ascension 2h. 57m., declination 51°, moved slowly towards β Camelus, exhibiting along the whole track a phosphorescent haze, and after attaining its maximum brilliancy, disappeared from view in right ascension, 4h. 40m., declination, 60°; after having been visible for fully six seconds. It was immediately followed by one whose path, when prolonged backwards, came close to ν Perseus. At 10h. 48m., one appeared from between ν and η Perseus, described a path 6° long, and faded near θ. At 11h., a bright one, equal to a star of 1st magnitude, came from right ascension, 1h. 40m., declination 61°, and disappeared close to 32 Cassiopeia; the path appeared to be foreshortened. 11h. 31m., one emerged from ε Cassiopeia, and was lost to view near η Perseus; it was followed at 11h. 51m., by one that appeared in right ascension 9h., declination 75°, and disappeared close to κ Draco. Between 11h. 51m., and 12h. none were detected.

Clouds prevented observations on the 12th. On the 13th, at 10h. 10m., one came from λ Perseus, and disappeared close to δ; it was followed by one at 10h. 21m., that came from Mirfak, and disappeared in right ascension 2h. 52m., declination 47°. At 10h. 46m. one came from Algol, and travelled 9° in direction of ε Perseus; this was followed at 10h. 48m. by one from a point 1° north of Algol, that disappeared near κ Perseus; 11h. 40m. appeared from direction of 50 Cassiopeia, disappeared near θ. At 11h. 50m. a very bright one traversed a path that can be represented by a line drawn from μ Andromeda, midway between η and δ, to right ascension 0h. 25m., declination 30°. The luminous train continued visible for three seconds. 12h. 8m., the last observed, appeared near ψ Cassiopeia, and was lost to sight near ν Camelus.

The above-mentioned are only a few whose paths were determined accurately. A great many more were seen, but, owing to the rapidity of flight, combined with the diminution of luminosity by moonlight, their respective courses could not be traced with a sufficient degree of certainty necessary for projection. On the 12th the radiant for the Perseids lay near 45° + 53°, and on the 14th 50° + 49°. Theoretically, its position is 51° + 55°.

Liverpool, Aug. 16, 1884. W. K. Bradgate.

THE SATELLITES OF MARS: A COINCIDENCE.

[1378]—Is it not truly noteworthy that Swift, in his "Voyage to Laputa," should have written: "They have likewise discovered two lesser stars, or satellites, which revolve about Mars, whereof the innermost is distant from the centre of the primary planet exactly three of his diameters, and the outermost five; the former revolves in the space of ten hours, and the latter in twenty-one and a half"?

I do not recollect whether the Laputan observers were right, or nearly so, as to distances; but if not, the discovery of these moons' existence in the middle of the eighteenth century is sufficiently striking. Simplex.

[It must not be assumed that the Dean of St. Patrick's was speaking of an actual discovery in the words which "Simplex" quotes. In reality, Phobos, the satellite nearest Mars, is only about a diameter and a half of the planet from his centre, and

goes round him in 7h. 39m. Deimos, the outer satellite, is rather more than three and a half diameters of Mars from his centre, and has a period of revolution of 30h. 18m. Even with these discrepancies, though, the coincidence is sufficiently remarkable.—Ed.]

A GHOST—A FACT.

[1379]—As General Sherbrooke was sitting after dinner with General Winyard, in America, a figure appeared between them and the fire, dressed in uniform and a *strange-looking new hat*. After a pause, it retired through a door into an adjoining room; the Generals followed, and were somewhat alarmed on finding no one there, there being no egress but by the door they had entered. General Winyard remarked that the figure bore the strongest resemblance to his brother, then in England. The time of its appearance was therefore noted down, and it was afterwards ascertained that that very brother died at that very hour. Upon General Sherbrooke's return to England he one day met in London General Winyard's father, who introduced the subject and asked for a description of the *appearance;* General Sherbrooke, having never seen General Winyard's brother, observed that it was very like that gentleman, pointing to a person passing at that moment near them. Now it is very singular that that gentleman was known to Mr. Winyard, the father, and had always been reckoned a striking likeness of his late son. It is further remarkable that the regiment to which the young Winyard belonged was ordered about the time of his death to wear a new kind of hat, of rather an extraordinary make, as the army then thought, and this new military hat the ghost appeared in.

Arthur S. Lodge.

[The very familiar story related by Mr. Lodge is told with decided variations in the details. See for one version Howitt's translation of "Ennemoser's History of Magic," Vol. II. pp. 380, *et seq.* in Bohn's "Scientific Library."—Ed.]

DAISIES.

[1380]—Many months since Mr. Grant Allen, in Knowledge, said some very elegant and pretty things in favour of daisies; but it didn't make me love his pets then, and I don't like 'em now.

An amateur daisy-killer has, with sulphuric acid, turned half my lawn into brown spots, and it has the queerest look of hybrid efflorescence in a state of great discomfort.

Will Mr. Grant Allen kindly take compassion on a distracted lady, and say how she can get rid of his pets, being her pests, and so relieve the heart of a

Disconsolate Female?

LETTERS RECEIVED AND SHORT ANSWERS.

F. Overton.—To give the prices of books noticed in these columns would be to convert our reviews into advertisements.—J. G. Fisher. Thanks for your very courteous communication. Pray do not imagine that I consider our existing mode of spelling as absolutely perfect or inexpugnable. My replies were rather intended to indicate the impossibility of adopting Mr. Pitman's or any other novel form of orthography in a paper like this.—A.M.I.C.E. I shall be pleased to accord you permission to make whatever quotations you may require from the articles to which you refer; the sole condition being the acknowledgment that they are derived from this journal.—Julia Usher. Mädler's idea that Alcyone is the centre round which the orbit of our solar system through space is performed, is now absolutely exploded. He went so far as to predicate that that star was actually the centre of gravity of the entire visible stellar universe, an assumption now definitely disproved by the proper motions of a considerable number of stars. In reply to your second question, the instruments in use at the Royal Observatory at Greenwich are by various makers. To begin with, the oldest (I mean the oldest now ever employed), the Shuckburgh Equatoreal: this is the work of that famous optician Ramsden, who flourished during the latter half of the last century. The Sheepshanks Equatoreal has a Cauchoix object-glass, but the mounting is by Mr. Grubb, of Dublin. The capital instrument of the Observatory, the Great Transit Circle, has an objective made by Troughton & Simms, who are largely responsible for the rest of this superb instrument. Messrs. Ransomes & May, Ipswich, however, cast and turned the massive metallic parts of it. The Altazimuth is by the same makers. The object-glass of the Great Equatoreal was made by Merz & Son, of Munich; the engineer's work by Ransome & Sims (successors to Ransomes & May); the graduation and mounting generally by Mr. Simms. There is a reflecting telescope of 24 in. in aperture in the grounds, constructed by that eminent amateur, the late Mr. W. Lassell; a 6-in. equatoreal, by Cooke & Sons, of York; another of the same dimensions by Simms, and so on.—C. E. Johnson. Speaking off-hand, I should say that the Castle in the Arms of Northumberland had *not* any connection with that in the Arms of Spain; but that its origin was rather to be sought in something akin to what gave the name of Newcastle to its chief town, *i.e.*, the building of a fortress, or new castle, by Robert, William the Conqueror's son, on his return from Scotland, probably on the site of an ancient Roman fortification. Perhaps some heraldic reader will notice this question. In reply to your second question, the late Mr. John Payne Collier, the eminent Shakespearean scholar, wrote a work entitled "Punch and Judy;" I forget the publisher's name. There are, too, references to that subject scattered up and down *Notes and Queries*. Or, again, you will find an excellent *précis* of what is known—or conjectured—on the origin of our popular street drama, in an article entitled "Punch and the Puppets," on p. 517 of Vol. VII. of the New Series of *All the Year Round*. This is, I imagine, exactly what you require.—Paul Schutz. Received.—S. G. Your bees have no doubt been both decapitated and eviscerated by Tits, those destructive little birds being among the worst enemies they have. Cockchafers, too, will sometimes destroy them in somewhat similar fashion.—H. G. F. Taylor. I am unable to add to the four names you mention, save with those of men who have merely temporarily influenced large masses, such as Peter the Hermit, Savonarola, &c.—Exhibitioner. Mr. Twiss must have an intellectual twist of a remarkable description. He might approximately measure the diameter of a garden-roller by his method; but to acertain that of a cylinder ¼ inch in diameter—for any accurate purpose—in the same way, would be utterly impossible. Plenty of people can "square the circle" with a two-foot rule and a piece of string; albeit, the actual operation is demonstrably impracticable.—Reader. The mammæ is the male sex, like the os coccyx (or rudimentary tail at the end of the spinal column), the incisor teeth of ruminants which never penetrate the gums, &c., are one and all organs which have become rudimentary from disuse. They were doubtless originally parts acquired by one sex and partially transmitted by inheritance to the other, and afford yet another proof of the evolution—as contradistinguished from the special creation—of species. At a very early embryonic period both sexes possess true male and female glands. Hence in the dimmest ages of the past it would seem that the progenitor of the mammaliæ—nay, of the whole vertebrate kingdom—must have been hermaphrodite—G. Lacy Hillier. Received.—X. B. T. There is no such (recognised) society as that which you name. It is absent from the exhaustive list on pp. 221 to 224 of "Whitaker's Almanack." Its title suggests some sort of quackery or paradox.—Alex. Smith. The idea of Olbers, that the planetoids are fragments of a larger body which has exploded, has long since suffered that fate itself. Dismissing this, though, how about the dynamics of your "wobbling" ring—and whence its "wobble"? See, moreover, pp. 173 to 192 of "The Expanse of Heaven." Some of the most remarkable of the variable stars (judged by the colour-test) are among the very oldest—*e.g.*, T. Cassiopeiæ, R. Sculptoris, R. Doradûs, R. Leporis, S. Aurigæ, S. Orionis, and so on. Are you familiar with Pickering's admirable researches on variable stars?—J. Greevz Fisher. Received.—W. G. Reeve. It is impossible for me to make a personal appointment to view your orrery.—Mrs. Robert Langton. I regret my inability to help you. Type-writing is a thing rarely if ever performed, if I may so speak, vicariously. I question if the possession of that accomplishment would be of the smallest use to the young lady, who, by the by, already writes a hand scarcely surpassed in beauty and legibility by any merely mechanical work.—A. B. As the most absolutely contradictory opinions have been expressed on the question of the influence of sun-spots on terrestrial temperature, it is safest to say that no evidence exists that they affect it at all.—M. M. Heron. The lady to whom your letter is addressed is at present not in England.—T. R. Clapham. Thanks. Perhaps "Our Place among Infinities."—H. Romeike. We number every scientific journal of repute or standing among our list of weekly receipts, and so obtain, at first hand, what you obligingly proffer.—J. T. Routledge. You have hit the blot in Professor Stewart's reasoning (?). Those who argue after this fashion postulate such a perfect knowledge of the entire physical universe as the majority of those whom they address will scarcely credit them with possessing. There would be no insuperable difficulty in showing that $2+2=5$ if such arguments as you quote were valid.—W. H. Harrison. To print your letter would be simply to give to the paper to which it refers a gratuitous advertisement in Knowledge, for which it has been long striving. Its efforts to provoke me into a discussion to this end have been so transparent as to be amusing; but I have treated it with a contempt which I am a little surprised to find that you do not seem to share. Why in the world need you or I take the very slightest notice of abuse in a publication of such an order as that?

XUM

Our Chess Column.

By Mephisto.

SOLUTION.

Problem No. 123, p. 146.

1. Kt to Kt7	K × B, or		K × P
2. Q to K8	Mate	2. Kt to Q8	Mate
If	K to Q2	If	B × R
2. Kt to B5	Mate	2. Q × R	Mate
If	R moves	If	K to K4
2. Kt to Q8	Mate.	2. Q × R	Mate.

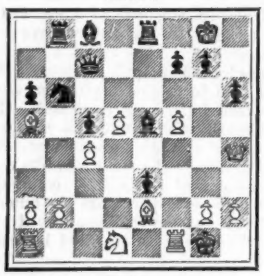
A well-fought Consultation Game, played at the Chess Club, at Amsterdam :—

Two Knight's Defence.

White. R J. Loman and B. J. Meyer.	Black. Herr von Forrest and H. J. Sohlberg.
1. P to K4	P to K4
2. Kt to KB3	Kt to QB3
3. B to B4	Kt to B3
4. Kt to Kt5	P to Q4
5. P × P	Kt to QR4
6. B to Kt5 (ch)	P to B3
7. P × P	P × P
8. B to K2	P to KR3
9. Kt to KB3	P to K5
10. Kt to K5	B to Q3 (*a*)
11. P to KB4 (*b*)	Q to B2
12. P to Q4	Castles
13. Kt to QB3	P to QR3 (*c*)
14. Castles	R to Q sq.
15. B to K3	P to B4
16. Q to K sq.	R to Kt sq. (*d*)
17. Kt to Q sq.	Kt to Q4
18. B to Q2	Kt to QB3
19. Kt × Kt (*e*)	Q × Kt
20. P to B4	P to K6 (*f*)
21. B to QR5	Kt to Kt3
22. P to Q5	Q to B2
23. Q to R4	R to K sq.
24. P to B5	B to K4 (*g*)

Position after Black's 24th move.

Black.



White.

White.	Black.
25. P to B6 (*h*)	B × P
26. R × B	P × R (*i*)
27. Q × RP	Q to K4
28. P to KR4 (*j*)	Kt to R5 (*k*)
29. Kt to B3	R × P
30. B to Q3	B to B4 (*l*)
31. B to B7 (*m*)	Q × B
32. B × B	Resigns (*n*).

NOTES.

(*a*) This move seems to afford the best chance for Black in this defence.

(*b*) It is requsite to advance this Pawn before the QP.

(*c*) To prepare for P to B4.

(*d*) Here the following line of play seems advantageous for Black :—

16.	P × P
17. B × P	B to R6
18. P × B	R × B

and White's position is somewhat disarranged.

(*e*) A judicious exchange, by which the subsequent advance of the Pawns becomes more effective.

(*f*) A premature advance, which weakens Black's game; they ought to have returned Kt to K2, for the better protection of his K's side.

(*g*) P to B3 would have stopped the advance of the bold BP

(*h*) White is assuming the offensive in a very vigorous manner; they are prepared to give up the exchange.

(*i*) It certainly seems to us that Black ought to be able to defend the position.

(*j*) To prevent Q to Kt4.

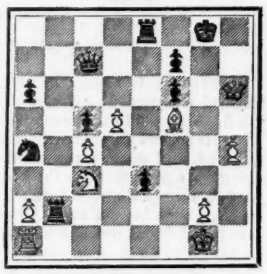
(*k*) To stop B to QB3. But we should have ventured upon Q to B4, to be followed by Q to Kt3.

(*l*) Of course Black did not see White's reply; the only other move, P to B4, would result in the loss of the Black Kt, after Q to Kt5 (ch).

(*m*) Very fine play. Black has no satisfactory reply.

(*n*) The position is both interesting and instructive, and will well repay a little study. To many players it will by no means be clear why Black resigned at this point, although he may have the worst of it, yet with *precise* and *correct* play White can force a win very soon. Apparently B to R7 (ch), K to R sq., B checks, K to Kt sq. or Q to R7 does not directly threaten mate. If, therefore, as it is Black's move, he should play 32. Kt × Kt, White would reply with the preparatory move of 33. P to Q6, to which there is no answer, for if Q × P 34. B to R7 (ch), K to R sq. 35. B to Kt6 (ch), K to Kt sq. 36. Q to R7 (ch), K to B sq. 37. Q × P mate. It is equally bad if the Q does not take the P, for then Q to R7 (ch), followed by Q to R8 mate. It is, therefore, evident that Black cannot withdraw the Q from guarding the BP, and also that he must prevent P to Q6, which blocks K2, but how? If Black plays 32. R to Q sq. 33. Kt to K4 wins. Or if 32. R to Q7, White has several ways of winning, the simplest probably being 33. P to Q6, R × P. 34. Kt to Q5, R × Kt. 35. P × R (again threatening P to Q6), R to Q sq. 36. R × P and mate in two. Again, if Black plays 32. R to Kt3, White can play as before, P to Q6 and win.

Black.



White.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

S. B. C.—We have not seen Horwitz's book. The Problem 120 cannot be solved by Q to B2, as B to Kt2 defends.

H. A. Du Croz.—Problem 121. If 1. Q to Q3, K × R. 2. Q to B3 mate.

J. M. Melville.—Problem 120. If 1. Q to Kt5, K to Kt7, then 2. Q to B sq. mate.

Correct solutions received. — Problem 122, M. T. Hooton. No. 123, A. W. Overton, W., H. A. N., C. T. G., Donna. No. 124, S. B. C. (both), John Watson, W.

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